Sector Guidance Note SG11 (draft)

Guidance for Wood Products Preservation with Chemicals

Part A2 – England and Wales
Part A – Scotland
Part A – Northern Ireland

September 2013

Revision of the guidance

The electronic version of this publication is updated from time to time with new or amended guidance. **Table 0.1** is an index to the latest changes (minor amendments are generally not listed).

Table 0.1 - Revision of the guidance		
Date of change	**Section/ paragraph where change can be found**	**Nature of change** **- what paragraphs have been inserted, deleted or amended** **- what subject matter is covered by the change**

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1. Introduction

Legal basis

1.1 This Note applies to the whole of the UK.

1.2 This guidance document is compliant with the Code of Practice on Guidance on Regulation page 6 of which contains the "golden rules of good guidance". If you feel this guidance breaches the code, or notice any inaccuracies within the guidance, please contact us.

1.3 This is one of a series of statutory notes[1] giving guidance on the Best Available Techniques (BAT)[2]. The notes are all aimed at providing a strong framework for consistent and transparent regulation of installations regulated under the statutory Local Air Pollution Prevention and Control (LAPPC) regime in England and Wales, Scotland and Northern Ireland. The note will be treated as one of the material considerations when determining any appeals against a decision made under this legislation.

1.4 In general terms, what are BAT for one installation in a sector are likely to be BAT for a comparable installation. Consistency is important where circumstances are the same. However, in each case it is, in practice, for regulators (subject to appeal) to decide what are BAT for each individual installation, taking into account variable factors such as the configuration, size and other individual characteristics of the installation, as well as the locality (eg proximity to particularly sensitive receptors).

1.5 The note also, where appropriate, gives details of any mandatory requirements affecting emissions which are in force at the time of publication, such as those contained in Regulations or in Directions from the Government. In the case of this note, at the time of publication the mandatory requirements are those contained in the EU Industrial Emissions Directive. The Regulations referenced in paragraph 1.3 put the Directive requirements into UK law.

Who is the guidance for?

1.6 This guidance is for:

Regulators

1 This and other notes in the series are issued as statutory guidance in England and Wales under regulation 64(2) of the Environmental Permitting Regulations. The notes are also issued as non-statutory guidance in Scotland and Northern Ireland.
2 Further guidance on the meaning of BAT can be found for England and Wales (in chapter 12), Scotland, and Northern Ireland, (in Chapter 9).

- local authorities in England and Wales, who must have regard to the guidance when determining applications for permits and reviewing extant permits
- the Scottish Environment Protection Agency (SEPA) in Scotland;
- district councils or the Northern Ireland Environment Agency (NIEA) in Northern Ireland;

Operators, who are best advised also to have regard to it when making applications and in the subsequent operation of their installation

Members of the public, who may be interested to know what the Government considers, in accordance with the legislation, amounts to appropriate conditions for controlling emissions for the generality of installations in this particular industry sector.

Updating the guidance

1.7 The guidance is based on the state of knowledge and understanding, at the time of writing, of what constitutes BAT for this sector. The note may be amended from time to time to keep up with developments in BAT, including improvements in techniques, changes to the economic parameters, and new understanding of environmental impacts and risks. The updated version will replace the previous version on the Defra website and will include an index to the amendments.

1.8 Reasonable steps will be taken to keep the guidance up-to-date and to ensure that those who need to know about changes to the guidance are informed of any published revisions. However, because there can be rapid change to matters referred to in the guidance - for example to legislation - it should not be assumed that the most recent version of this note reflects the very latest legal requirements; these requirements apply.

1.9 The EU will in time publish BAT Conclusions which will be based upon the outcomes of the Sevilla process to develop a reference document for this sector (Bref Note). This Guidance will be reviewed in line with these outcomes. The EU Industrial Emissions Directive requires all member states to incorporate BAT conclusions into Permits and all installations to achieve BAT conclusions within 4 years of their publication.

Consultation

1.10 This note has been produced in consultation with relevant trade bodies, representatives of regulators and other potentially-interested organisations.

Policy and procedures

1.11 General guidance explaining LAPPC and setting out the policy and procedures is contained in separate documents for England and Wales, Scotland and Northern Ireland.

Timetable for compliance and reviews

Existing processes or activities

1.12 The new provisions of this note and the dates by which compliance with these provisions is expected are listed in the table below. Compliance with the new provisions should normally be achieved by the dates shown.

Table 1.1 - Compliance timetable

Relevant paragraph/BAT No in this note	Compliance date
BAT 1 - 3	7th July 2015
BAT 4 - 5	7th July 2016
BAT 6 - 27	7th July 2015
BAT 28	7th July 2017
BAT 29 - 35	7th July 2015
BAT 36 - 37	7th July 2017
BAT 38 - 52	7th July 2015
BAT 53	7th July 2017
BAT 54 - 83	7th July 2015
BAT 84	7th July 2016
BAT 85 - 107	7th July 2015
BAT 108 - 109	7th July 2016
BAT 110 - 139	7th July 2015

1.13 Replacement plant should normally be designed to meet the appropriate standards specified for new installations or activities.

1.14 For new activities, the permit should have regard to the full standards of this guidance from the first day of operation.

1.15 For substantially changed activities, the permit should normally have regard to the full standards of this guidance with respect to the parts of the process that have

been substantially changed and any part of the process affected by the change, from the first day of operation.

Permit Reviews

1.16 Under LAPPC the legislation requires permits to be reviewed periodically but does not specify a frequency. It is considered for this sector that a frequency of once every eight years ought normally to be sufficient for the purposes of the legislation. Further guidance on permit reviews is contained in the appropriate General Guidance Manual for England and Wales, Scotland and Northern Ireland. Conditions should also be reviewed where complaint is attributable to the operation of the process and is, in the opinion of the regulator, justified.

Regulations

1.17 This Note applies to LAPPC activities for the chemical treatment of wood and wood products. The activities are listed for regulation as follows.

Table 1.2 - Regulations listing activities

Activity	England and Wales	Scotland	Northern Ireland
	EPR reference	PPC Schedule 1	PPC Schedule 1
Preserving wood with chemicals (other than sapstain only) with a production capacity of > 75m^3 per day	Schedule 1 Section 6.6 Part A2	Schedule 1 Section 6.6 Part A	Schedule 1 Section 6.6 Part A
Solvent Consumption of activity			
> 150kg/hr or > 200te per year	Schedule 1 Section 6.4, Part A2	Schedule 1 Section 6.4 Part A	Schedule 1 Section 6.4 Part A
> 25te per year	Schedule 2 Pt 1	Schedule 2 Pt 1	Schedule 1 Section 7 Part C
Treatment of >1000m^3 of wood or wood products, but with a solvent consumption of < 25te per year	Schedule 1 Section 6.6, Part B	Schedule 1 Section 6.6, Part B	Schedule 1 Section 6.6, Part C

Production Capacity

1.18 Where the Regulations define an activity depending on its capacity, it is for operators to determine the relevant production capacity for approval by the regulator. Production capacity is not determined by actual output or throughput but by potential output which is only limited by technical or legal restrictions. An

example of a technical restriction would be by volume of a treatment vessel, an example of a legal restriction would be a limitation on operating hours such as by control under a planning consent which prevents the installation from running over a 24 hour time period.

1.19 When the operator carries out several activities of the same description in different parts of the same site, the production capacities must be added together.

1.20 Production capacities for all sectors obligated under IED are typically calculated on the greatest potential throughput for the site to ensure that sites are correctly identified.

1.21 For the treatment of wood the technical constituents of the process will not change for differing products as the only variation is normally in treatment cycle times. The site should consider the treatment cycle that has the shortest cycle time and should calculate on this basis as follows:-

Production Capacity = N x V

Where:-

N = Number of production cycles carried out in a 24 hour period

V = Volume of wood treated in each cycle

N will be determined by the process control system and should be based on the lowest treatment classification which the site will operate to, treatment classifications are specified by BS8417:2011 *Preservation of wood – Code of practice*. Classifications range from 1 - 4 with 1 being the shortest cycle time. The cycle time will be further refined by wood species as woods have a differing ability to take up chemical depending on the cell structure and sap content; however as a general rule “red wood” is the quickest wood to treat. Further complications to setting a uniform timescale for a red wood pack undergoing a class1 treatment relates to the differing treatment processes which are operated in this sector and the wide range of physical restrictions which relate to the variety of pipes, valves, tanks and pressure vessels.

An example of a cycle time for red wood treated to class 1 would be 65 minutes, however whitewood treated to class 4 may take as long 295 minutes. Both products will use exactly the same technology in exactly the same manner only the treatment times will vary.

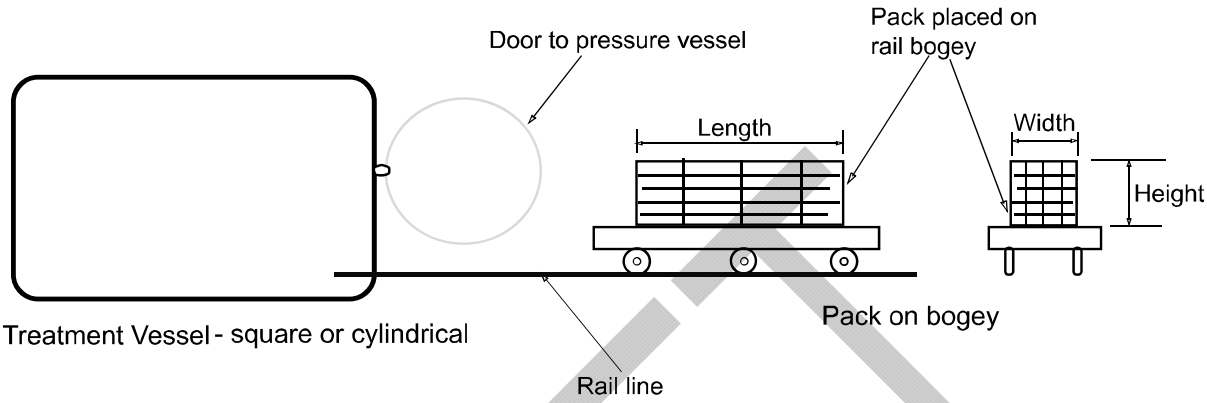
Example of cycle times											
Use Class		Pull Down	Initial Vac	Vac Fill	Pressure Period Typical	Empty	Final Vac	Purge / Recovery	Change Over	Total Expected Cycle	
										Min	Max
1	Baffle & T Car	5	5	5	5	10	15	5	5	55	55
	No Baffle & T Car	5	5	10	5	20	15	5	45	110	110
2	Baffle & T Car	5	5	5	7	10	15	5	5	55	65
	No Baffle & T Car	5	5	10	7	20	15	5	45	110	120
3	Baffle & T Car	5	15	5	25	10	15	5	5	70	90
	No Baffle & T Car	5	15	10	25	20	15	5	45	125	145
4	Baffle & T Car	5	15	5	170	10	30	5	5	195	255
	No Baffle & T Car	5	15	5	170	10	30	5	45	235	295

As treatment chemical suppliers guarantee the efficacy of the chemical which they supply they need to be able to set the treatment cycle conditions for each specific treatment system operated on each site to achieve the required treatment classification and on this basis these suppliers will be able to provide treatment cycle times for red wood packs which are to be treated to class 1. The sites will also hold “charge sheets” which are developed by treatment chemical suppliers which identify the process timings for specific products.

N will also include the time taken to load and unload the plant loading system with wood to be treated as this will be a factor in the number of production cycles achievable. This loading and unloading time will be directly related to the operational practices operating on site with single rail systems which require to be unloaded and reloaded by a single vehicle having the longest times while automated systems with multiple lines being the quickest. As the vessels are

unproductive during loading/unloading it is normal operational practice to limit this time.

V is determined by calculating the volume of treatment area within the treatment vessel. As each site will only treat wood packs that are attached to a plant loading system and as this system is site dependant it will be practicable to calculate volume based on maximum pack size using a simple length x breadth x height.



Where there is more than 1 treatment vessel in use the production capacity for each individual vessel should be calculated and then added to the other production capacities for each separate vessel to give a daily production capacity for the installation.

European Union Industrial Emissions Directive (IED) (Solvent emission activities)

1.22 The IED requires installations where wood products are chemically treated with solvent containing materials, and where the solvent consumption is more than 25 tonnes a year, to meet specified standards.

1.23 When using any SG note which implements Chapter V of the IED some parts of the note must be complied with by all SE installations. In this SG note the compulsory requirements are in boxes headed "SE Box".

1.24 Chapter V of the IED offers three ways of compliance:

- complying with SE emission limits and fugitive emission limits,
- complying with SE total emissions limits,
- applying the SE reduction scheme.

Annex VII Part 2 of IED states which of the above options are available for the activity being regulated.

1.25 For wood treatment the first two options are available. The following table sets out which paragraphs of this Note are therefore relevant for this activity. However option 1, (Emission & Fugitive Limits), is currently not used by the sector. The option has been left in the Note in case it is required at a future date.

Table 1.3 - Wood treatment, operating conditions and relevant paragraphs			
Installation	**Paragraphs of Guidance Note which apply (Note 1)**		
	Activities applying emission and fugitive limits	**Activities applying total emission limit**	
		Without VOC abatement	**With VOC abatement**
Single SE Activity. Solvent consumption >25 tonnes/annum	All SE Boxes except 3 & 7.	All SE Boxes except 2 & 7.	All SE Boxes except 2 & 7.
More than one SE activity	All SE Boxes except 3.	All SE Boxes except 2.	All SE Boxes except 2.
An SE activity is an activity falling within the scope of the Industrial Emission Directive (i.e. an activity as defined in Annex I, and which exceeds the thresholds in Annex IIA of the Directive). Consumption is the organic solvent consumption of the activity, (see Annex IIA of the Directive). Determination of consumption is described in paragraphs 4.5 of this Note. Note 1 - The SE Box will indicate which of the monitoring paragraphs apply.			

1.26 Chapter V of the IED requires replacement of certain solvents, as far as possible, in the shortest possible time. These are substances or mixtures which, because of their VOC content, are assigned or need to carry any of the following hazard statements H340, H350, H350i, H360D or H360F; there are further requirements which apply to the use of those materials, and to halogenated VOCs assigned hazard statements H341 or H351.

2. Emission limits and other provisions

Emissions to air associated with the use of BAT

Table 2.1 - Other VOC emission limits						
Row	**Activity**	**Emission Limit (mg/Nm^3) (Note 1)**	**Fugitive Limit (% of solvent input) (Note 1)**	**Reduction Scheme Target (Note 1)**	**BREF Emission value associated with BAT**	**BREF Comments**
1	Wood Impregnation	100	45% of solvent input	Total Emission Limit Value 11 kg/m^3	No specific BREF targets	
Note 1: Limits are derived from the Industrial Emissions Directive) and are the mandatory minimum standard The surface area of any product dealt with in the table above is defined as follows: Computer aided design or other equivalent methods shall be used to calculate the surface area of the other parts added, or the total surface area coated in the installation. Compliance is achieved if the Total Emission from the activity divided by the surface area of the coated is equal to or less than the Total Emission Limit Value						

2.1 The monitoring requirements for the activities described in **Table 2.1** are detailed in **Table 2.2**.

Table 2.2 - Monitoring Requirements for VOCs	
Activity	**Monitoring Requirements**
All activities	**Emission Limits from:**
	a) Unabated releases:- Once a year extractive monitoring.
	b) Abated releases:- Continuously recorded indicative monitoring, plus once a year extractive monitoring
	Fugitive emission limits
	Target emission – Annually
	Total Emission Limit – Annually

Benchmark emissions to water associated with the use of BAT

2.2 Due to the presence of active biocides and fungicides within the chemical preparations used to chemically treat wood products it is highly unlikely that any process water will ever be discharged from site and any discharges will therefore solely focus on uncontaminated surface water.

2.3 Should water be discharged from site then limit values for water discharges will be specified in individual cases taking account of the receiving environment. For discharges to sewer conditions will be contained within the trade effluent discharge consent and would not normally be replicated in the PPC permit (except in NI). For discharges to controlled water limits to ensure compliance with the receiving water EQS will be indicated by the Environment Agency, Natural Wales, SEPA or NIEA depending on the location of the discharge.

2.4 On-site wastewater treatment systems are likely to be limited to physical treatments as the biocide and fungicide loading of process water will overwhelm most treatment systems. It is also practicable in many cases to re-use treated water. Table 2.3 provides information regarding achievable levels associated with the use of wastewater treatment systems for discharge to surface water.

Table 2.3 - Examples of emission limits to surface water from an ETP associated with the use of BAT

Determinand	Concentration (mg/litre)
BOD	100
Total hydrocarbon oil	5
Total suspended solids	20
Ammoniacal nitrogen (expressed as N)	15
PH	6 – 10
COD	1000
Sulphate as SO4	1000

3. Process description

3.1 This note refers to preservation of wood or wood products with chemicals, including organic solvent based and water based chemicals, other than for exclusively treating sapstain in an installation with a production capacity of more than 75m^3 per day.

In the rest of **this section only** “process” should be understood to describe the various stages involved in the wood treatment operations. It does not necessarily have the same meaning as elsewhere in this note.

3.2 In the context of this note, "process" or “activity” comprises the whole process from receipt of raw materials via production of intermediates to dispatch of finished products, including the treating, handling and storage of all materials and wastes relating to the process.

3.3 Sapstain is a blue or grey staining formed on cut or felled timber by fungi. Sapstain treatment is carried out using treatment chemicals which act as fungicides. Treating wood exclusively for sapstain is not considered to be an activity under the IED.

3.4 Wood is treated with preservative to prevent rot and/or insect attack when the wood is in storage or in use. A preservative is any substance or mixture consisting of, or containing, one or more active ingredients. Most wood preservatives are delivered to site as a concentrate for dilution in water or an organic solvent. Some are delivered in ready for use form not requiring further dilution. Wood preservatives on the UK market must be approved under the Control of Pesticides Regulations 1986 (as amended) or the Biocidal Products Regulations.

3.5 Process parameters vary depending on the use class of the wood in service and the desired service life. Treatment may be determined by a project designer, the customer or by the treater or wood stockist if treating for stock. Specifications include BS 8417: 2011, *Preservation of wood – Code of practice*, WPA manual *Industrial Wood Preservation – Specification and Practice* and users own specifications such as those for poles and sleepers.

3.6 The treatment plant consists of two main components. These are the treatment vessel that may be a cylindrical or rectangular pressure vessel and one or more storage tanks.

The treatment vessel incorporates a loading system to enable packs of wood to be moved in and out, either manually or automatically. The treatment vessel door incorporates safety devices to prevent the process starting until the door is fully closed and locked and to prevent it being opened until all preservative is removed. There are normally two storage vessels; one is the working vessel which holds the

preservative to flood the treatment vessel and the other is the bulk tank which is used to accept delivery of new preservative and to replenish the working vessel.

3.7 Once the wood is loaded into the treatment vessel and the door is closed and safely locked, the process is carried out as follows:

There are six main stages, though Stage 1 may be omitted or replaced with an air pressure phase:

1) Initial vacuum - an initial vacuum is used to take air out of the wood. The length of this vacuum period and level used vary according to the specification being followed. The amount of air removed will affect the final uptake and penetration of preservative. To control retention some processes run without applying an initial vacuum.

2) Flooding - the preservative solution is transferred from the working vessel to the treatment vessel. If applied, the vacuum is maintained during transfer.

3) Pressure Period - once the treatment vessel is full the vacuum is released and, unless atmospheric pressure only is to be used, hydraulic pressure is applied using a pump. The wood is held in the preservative for a period of time. Pressure is then released in a controlled manner.

4) Initial Drain - at the end of the pressure period the preservative is transferred back to the working vessel.

5) Final Vacuum - a final vacuum is applied to the wood both to remove any excess preservative from the surface layer of the wood and to reduce dripping of the treated wood at the end of the process. As this vacuum is released, air moves back into the vessel and into the surface cells of the wood, carrying with it some of the residual preservative fluid on the wood surface. This stage may be replaced or augmented when using steam conditioning to initiate drying of the treated wood.

6) Final Drain - during the final vacuum, the preservative collected in the treatment vessel is pumped back into the working vessel. Fresh air is often drawn through the vessel before the wood is removed to remove vapour from the working area around the door to minimise operator exposure.

3.8 Wood is loaded in packs or, when large-dimension wood components (e.g. poles) are being treated, as individual pieces. Packs/pieces may be placed in the treatment vessel at an angle to promote dripping that ensures the wood emerges as dry as possible from the treatment process. The treatment vessel is filled with wood to capacity whenever practical.

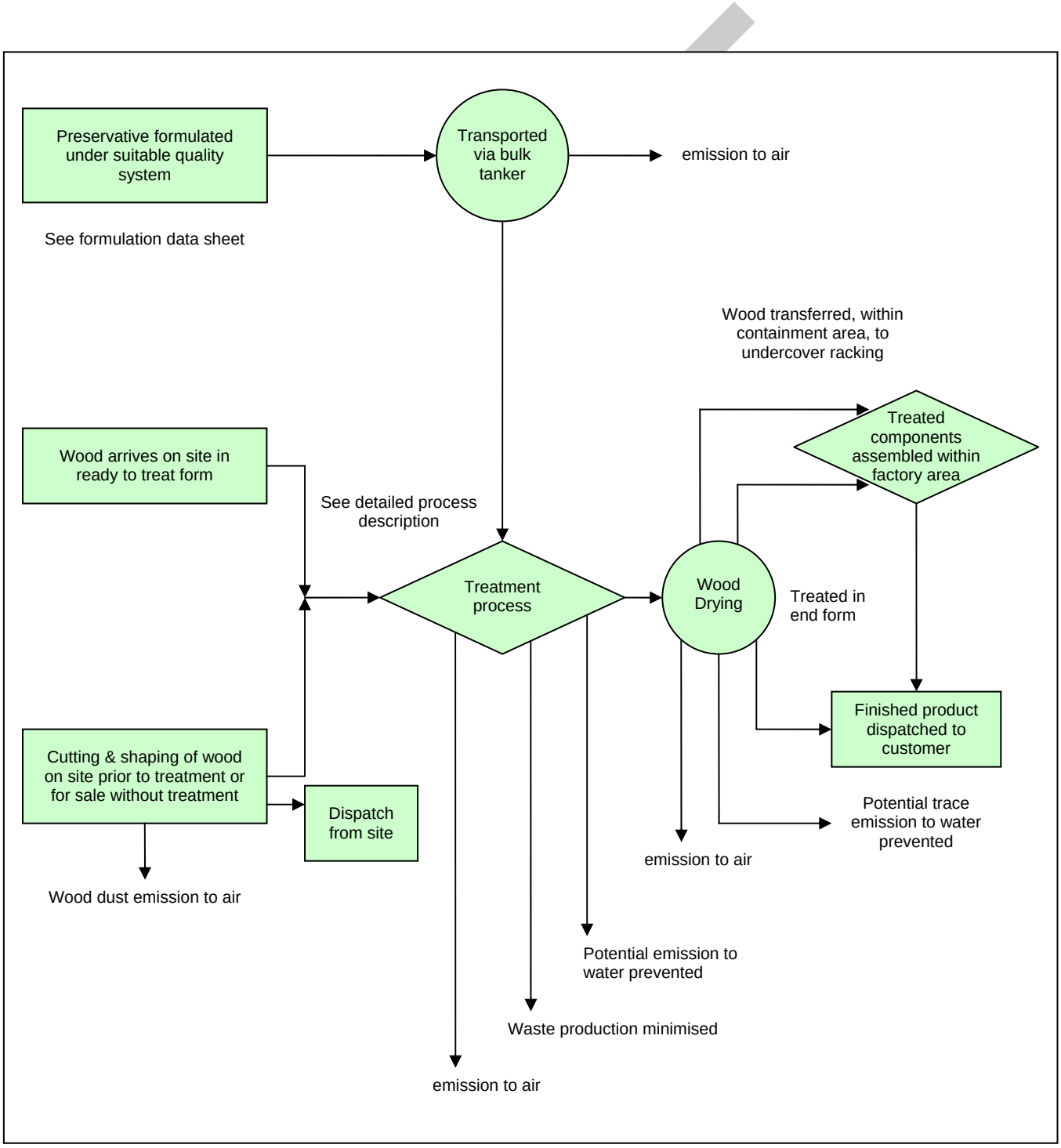
3.9 Atmospheric releases occur when transferring preservative from the road delivery tanker to the bulk vessel, from one vessel to another, from the vacuum pump systems, and from the treated wood itself. When any droplets may be present in air such as from some vacuum systems the air is first passed through a coalescing

filter system. VOC emissions are vented out of the process building. The liquid from the coalescing filter is removed from site approximately once per annum.

3.10 Treated wood is removed from the treatment vessel and held on an impermeable, curbed and drained “drying area” where they sit until they are deemed to be dry.

3.11 Dry packs are moved off of the drying area for storage prior to delivery to the customer.

Figure 3.1 - Potential releases from a Typical Treatment Plant



4. Solvent emission limits

4.1 Emissions of the substances listed in SE box 2 below should be controlled.

4.2 The emission limit values and provisions described in this section are achievable using the best available techniques described in **Section 5**.

4.3 For VOC from SE activities two compliance options are available:

SE Box 1 - VOC compliance
(Article 5) All Activities

All installations must comply with either:

a) the emission limit in waste gases and the fugitive emission values in SE Box 2 or

b) The requirements of the total emission limit values in SE Box 3

Also, all installations must comply with the emission limits for designated risk phrase materials in SE Box 4.

(The reduction scheme option is not available for demonstration of compliance for this activity).

However the first of these options is not used by the sector and therefore the requirements of SE Box 2 are for information only.

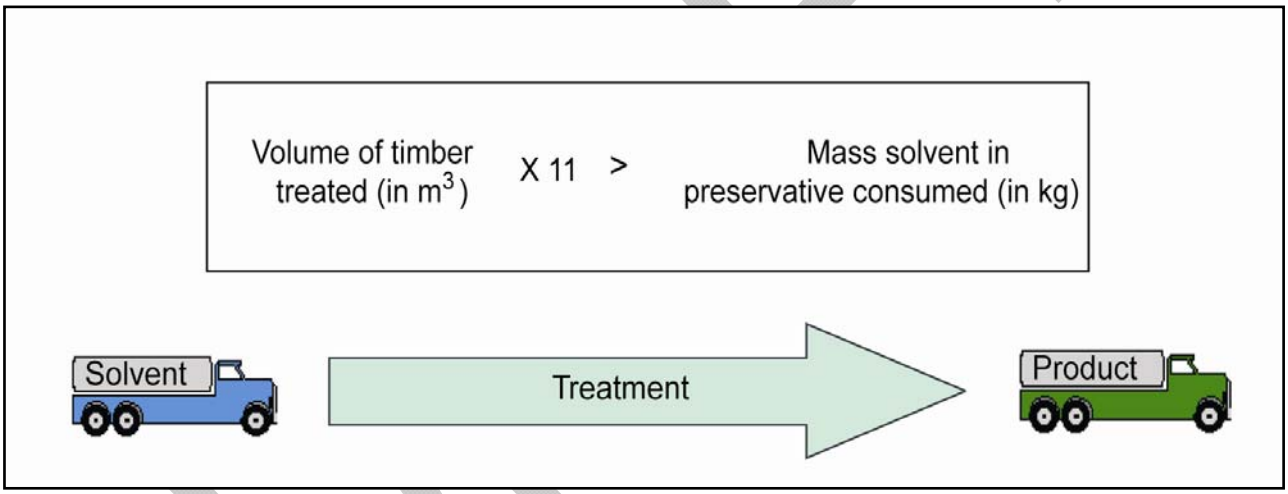
SE Box 2 - Contained and fugitive emission limits and requirements (Articles 5, 8, 9 & Annex IIA)				
For all activities not using the total emission limit values				
Row	**VOC in waste gases**	**Emission limits / requirements**	**Fugitive emission values**	**Monitoring**
1	All installations Organic solvent consumption of 25 tonnes or more.	VOC expressed as total mass of organic carbon, (Note 1)		
	Waste gases from oxidation plant used as abatement	150mg C/Nm^3 (Note 2)	25% of organic solvent input	Abated releases Continuous monitoring and recording See paragraphs 4.15 and 4.16 Plus Unabated releases Annual manual extractive testing See 4.17 Fugitive Emissions See Solvent Management Plan
		50mg C/Nm^3		
	Waste gases from other abatement plant	150mg C/Nm^3 (Note 2)		
		100mg C/Nm^3		
	Any other waste gases	100mg C/Nm^3		

Note 1 - The emission limit requirements should not apply to activities involving the use of creosote where no other organic solvent borne preservative is employed.

Note 2 - For abatement plant existing prior to 1 April 2001, the higher contained emission figure may be used until 1 April 2013 if the total emission from the whole installation (fugitive + contained emission) does not exceed after 1 April 2013 (fugitive + contained emission after 1 April 2013).

SE Box 3 (article 5, 8, 9) All activities using the Total Emission Limit Values Total Emission Limit Values SE activities			
All SE installations applying the Total Emission Limit Values			
Row	**VOC in waste gases**	**Emission limits / requirements**	**Compliance calculation**
1	All installations Organic solvent consumption of 25 tonnes or more.	11kg/m^3 (See Note 1)	Compliance with the total emission value per m^3 of wood treated is achieved if the total input of the solvent (in kgs), divided by the volume input of wood treated (in m^3) is less than or equal to the total emission limit value in the Table above. See Figure 4.1 also.

Figure 4.1 - Compliance Calculation



Determination of Solvent Consumption

4.4 Construction of inventories of materials consumed and disposed of may involve the identification of individual organic solvents, or solids. This may give rise to an issue of commercial confidentiality. Information supplied must be placed on the public register, unless exclusion has been granted on the grounds of commercial confidentiality or national security. (Further guidance can be found in the appropriate General Guidance Manual.)

4.5 A determination of the organic solvent consumption, the total mass of organic solvent Inputs minus any solvents sent for reuse/recovery off-site, should be made and submitted to the regulator annually, preferably to coincide with the operators stocktaking requirements, in the form of a mass balance in order to determine the annual actual consumption of organic solvent (C):

Where: $C = I_1 - O_8$

I_1 Total quantity of organic solvents, or their quantity in preparations purchased which are used as input into the activity.

A calculation of the purchased organic solvent Input (I_1) to the activity, is carried out by recording:

i. The mass of organic solvent contained in coatings, diluents and cleaners in the initial stock (IS) at the start of the accounting period; plus

ii. The mass of organic solvent contained in coatings, diluents and cleaners in the purchased stock (PS) during the accounting period.

iii. Minus the mass of organic solvent contained in coatings, diluents and cleaners in the final stock (FS) at the end of the accounting period.

Total Organic Solvent Input (I_1) = IS + PS – FS

Solvent Management Plan

4.6 The Solvent Management Plan provides definitions and calculations to demonstrate compliance with the VOC requirements of this note. The use of the standard definitions and calculations also ensures consistency of VOC compliance across installations with an industrial sector.

4.7 The definitions provided must be used in all calculations relating to the Solvent Management Plan (SMP) (Figure 4.2).

- for SE installations using the emission and fugitive limits, the SMP should be used for determining the fugitive emissions (SE Box 5). Once completed, it need not be done until the equipment is modified

Definitions

4.8 The following definitions provide a framework for the mass balance calculations used in determining compliance.

Inputs of organic solvent in the time frame over which the mass balance is being calculated **(I)**

I_1 The quantity of organic solvents or their quantity in mixtures purchased which are used as input into the process/activity (including organic solvents used in the cleaning of equipment, but not those used for the cleaning of the products).

I_2 The quantity of organic solvents or their quantity in mixtures recovered and reused as solvent input into the process/activity. (The recycled solvent is counted every time it is used to carry out the activity.)

Outputs of organic solvents in the time frame over which the mass balance is being calculated **(O)**

O_1 Emissions in waste gases.

O_2 Organic solvents lost in water, if appropriate taking into account waste water treatment when calculating O_5.

O_3 The quantity of organic solvents which remains as contamination or residue in products output from the process/activity.

O_4 Uncaptured emissions of organic solvents to air. This includes the general ventilation of rooms, where air is released to the outside environment via windows, doors, vents and similar openings.

O_5 Organic solvents and/or organic compounds lost due to chemical or physical reactions (including for example those which are destroyed, e.g. by thermal oxidation or other waste gas or waste water treatments, or captured, e.g. by adsorption, as long as they are not counted under O_6, O_7 or O_8).

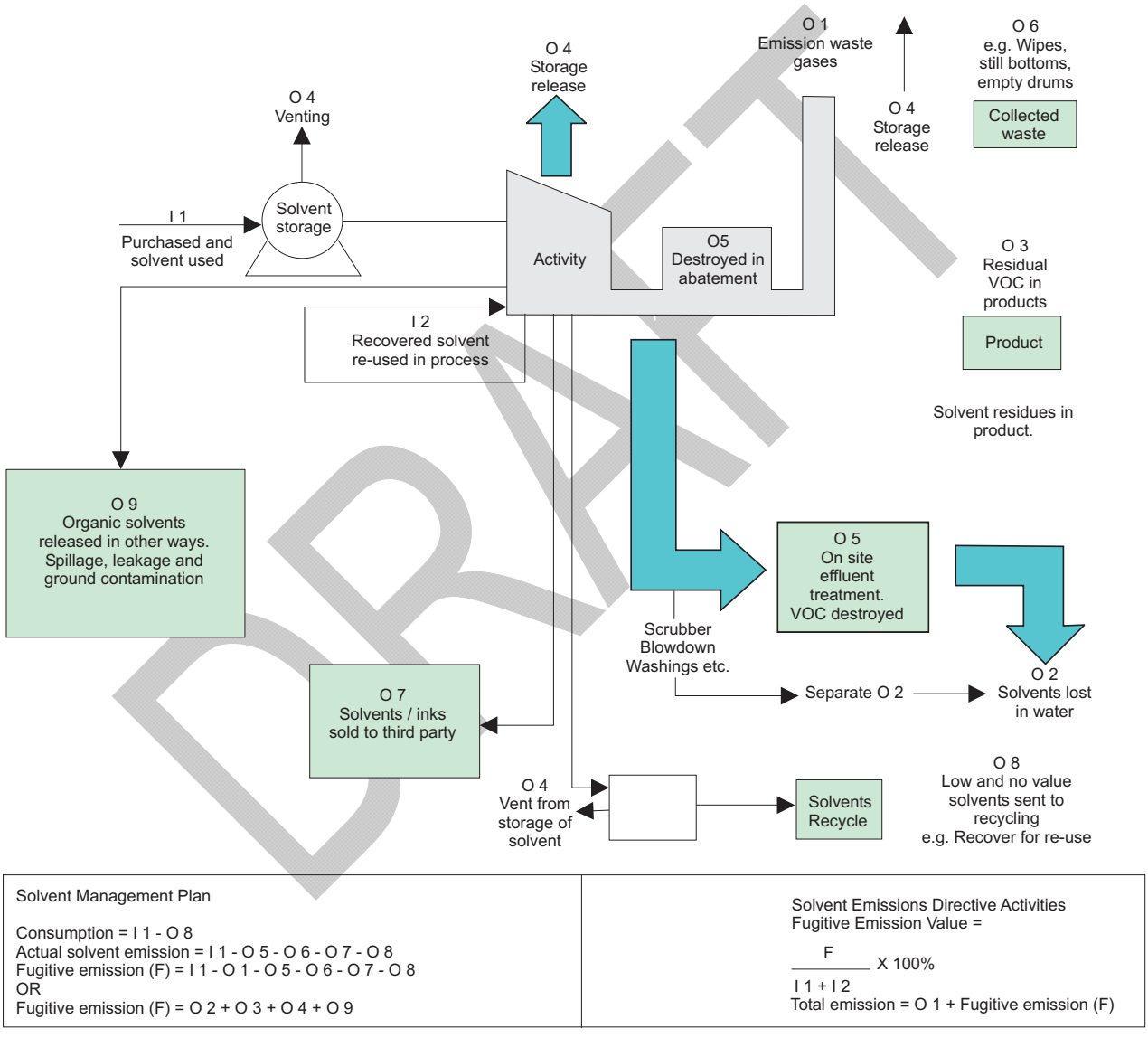
O_6 Organic solvents contained in collected waste.

O_7 Organic solvents, or organic solvents contained in mixtures, which are sold or are intended to be sold as a commercially valuable product.

O_8 Organic solvents contained in mixtures recovered for reuse but not as input into the process/activity, as long as not counted under O_7.

O_9 Organic solvents released in other ways.

Figure 4.2 - Solvent management plan inputs and outputs



Solvent Management Plan

Consumption = I 1 - O 8
Actual solvent emission = I 1 - O 5 - O 6 - O 7 - O 8
Fugitive emission (F) = I 1 - O 1 - O 5 - O 6 - O 7 - O 8
OR
Fugitive emission (F) = O 2 + O 3 + O 4 + O 9

Solvent Emissions Directive Activities
Fugitive Emission Value =

$$\frac{F}{I1 + I2} \times 100\%$$

Total emission = O 1 + Fugitive emission (F)

Designated Materials, Emission Limits and Conditions

<table>
<tr><td colspan="2">SE Box 4 - SE requirements for designated materials
(Articles 5,7,8,9)
All activities using designated materials

Designated materials used in SE installations must be either replaced, or controlled and/or limited, as set out below.</td></tr>
<tr><td colspan="2">All SE installations
i.e. existing, new and substantially changed</td></tr>
<tr><td colspan="2">1. Materials designated:

• from 1 Dec 2010: hazard statement H340, H350, H350i, H360D, or H360F</td></tr>
<tr><td>Requirements:

Replace as far as possible, (taking into account guidance under article 7(1) of the IED), by less harmful substances or preparations</td><td>Timescale:

Installations must comply within the shortest possible time</td></tr>
<tr><td>Control under contained conditions as far as technically and economically feasible to safeguard public health and the environment, normally, in accordance with the guidance provided within Section 5 of the note.</td><td>Timescale:

Immediately (and see note below)</td></tr>
<tr><td>Limit - where the sum of the mass flows of all the discharges of all the compounds causing the designated labelling is greater or equal to 10g/h, a limit value of 2mg/Nm^3 for the mass sum of the individual compounds must apply.</td><td>Monitoring:

Annual manual extractive testing (See monitoring section and SE Box 6)</td></tr>
<tr><td colspan="2">2. Designated Materials: Halogenated VOC with designation:

• from 1 Dec 2010: hazard statements H341 or H351</td></tr>
<tr><td>Requirements:

Control under contained conditions as far as technically and economically feasible to safeguard public health and the environment, normally, in accordance with the guidance provided within Section 5 of the note.</td><td>Timescale:

Immediately (and see note below)</td></tr>
<tr><td>Limit - where the sum of the mass flows of all the discharges of all the compounds causing the designated labelling is greater or equal to 100g/h, a limit value of 20mg/Nm^3 for the mass sum of the individual compounds must apply.</td><td>Monitoring:

Annual manual extractive testing (See monitoring section and SE Box 6)</td></tr>
<tr><td colspan="2">N.B. Substances or mixtures of halogenated VOC which are classified as designated materials, after the date of publication of this note must apply the replace, control and limit requirements above within the shortest possible time from the date at which substances or mixtures or halogenated VOC became/become designated materials.

In determining the Shortest Possible Time, the operator will need to justify their timetables taking account of the guidance in the relevant chapter of the appropriate Guidance Manual.

Creosote is currently identified under a hazard statement however the Biocidal Products Directive evaluation may lead to a reclassification of this material and subsequent removal of the obligation above.</td></tr>
</table>

Visible Emissions

4.9 The aim should be to prevent any visible airborne emission from any part of the process. This aim includes all sites, regardless of location. Monitoring to identify the origin of a visible emission should be undertaken using BS 1747 Part 1, though more complex monitoring techniques might be required if this standard does not produce adequate results.

SE Box 5 - Non-compliance causing immediate danger (article 10) All Activities

In cases of non-compliance causing immediate danger to human health, operation of the activity must be suspended.

All of the following criteria should be taken into account:

- the toxicity of the substances being released
- the amount released
- the location of the installation; and
- the sensitivity of the receptors

4.10 Higher emissions may occur during start-up and shut-down of a process. These emissions can be reduced, by minimising, where possible, the number of start-ups and shut-downs and having adequate procedures in place for start-up, shut-down and emergency shut-downs.

All appropriate precautions must be taken to minimise emissions during start-up and shut-down.

Continuous monitoring VOC abated releases

4.11 This should not be required for this sector. In exceptional circumstances requiring a need for such monitoring, reference should be made to PG6/23 which contains general information on this topic.

SE Box 6 - VOC Monitoring

There are no monitoring requirements for releases to air from this sector. Records of solvent consumption and surface area of wood treated will need to be kept.

4.12 Exhaust flow rates from the treatment plant should be consistent with good operating practice and meet the requirements of the legislation relating to the workplace environment.

Monitoring of unabated Releases

4.13 Where emission limit values for VOC are consistently met without the use of abatement equipment, the monitoring requirement for those pollutants should be dispensed with subject to the paragraphs above.

Two or more SE activities within the same installation

SE Box 7 - All Installations with Two or More Activities
(Article 5 and Annex III)

Installations with two or more activities

Installations where two or more of the activities in Annex I of the Solvents Emissions Directive are carried out, each of which exceeds the threshold in Annex IIA of the Solvents Emissions Directive must:

1) as regards to Designated Risk Phrase Materials, meet the requirements specified in SE Box 4, for each activity individually;

2) as regards all other substances, either:

   (i) meet the requirements for each activity individually; or

   (ii) have total emissions not exceeding those that would have resulted had point (i) been applied.

When applying 2 (ii) above, the Solvent Management Plan should be completed to determine total emissions from all activities concerned. That figure must then be compared with the total emissions from the installation that would have resulted had the requirements of Annex II of the IED been met for each activity separately

5. Control techniques

Summary of Best Available Techniques

5.1 This section summarises, in the outlined BAT boxes, what best available techniques should be in most circumstances. The boxes should not be taken as the only source of permit conditions; compliance with emission limits and other provisions contained in this guidance note together with any relevant case-specific considerations will also need to be taken into account. For the sake of brevity these boxes simply use the term "BAT".

5.2 Where techniques or operating conditions are referred to in the BAT boxes below, provided that it is demonstrated to the satisfaction of the regulator that an equivalent or better level of control of environmental impacts will be achieved then other techniques or operating conditions may be used.

Installation description and in-process controls

5.3 The meaning of “installation” and “directly associated activity” can be found for England and Wales (in chapter 12), Scotland, and Northern Ireland, (in Chapter 9).

5.4 This section contains an overview of the wood treatment sector, including operations common to solvent and creosote activities.

5.5 Each subsector is described giving the following information:

- the activity and its controls
- the significance of the environmental impacts
- applicable BAT boxes

Delivery, storage and handling of raw materials

Summary of activities

5.6 Operators of chemical treatment installations, in which chemical solutions are used, purchase the necessary treatment products from third party suppliers for use directly in the treatment process.

5.7 Liquid products, which can contain solvent, are delivered in a variety of unit quantities, typically ranging from five litres/kilos to 1000 litres/kilos, supplied in rigid metal or plastic containers, 205 litre drums and intermediate bulk containers (IBCs). Although most solvents and treatment chemicals are delivered in bulk road tankers.

5.8 Bulk solvents and treatment chemical deliveries are discharged to bulk storage tanks.

5.9 IBCs are off-loaded by forklift truck and stored in designated storage areas.

5.10 Drums are off-loaded on pallets using a drum lift or vehicle tail lift and stored in designated storage areas.

5.11 Smaller containers may be off-loaded manually or on pallets and stored in designated storage areas.

5.12 For the prevention of accidents, the methods employed and the equipment used to ensure the correct handling, storage and use of flammable materials needs to be determined by trained personnel in accordance with the HSE guidance and the Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) SI2776 2002

Environmental impact

Water: Run-off from chemical contaminated areas, contaminated bund-water.

Land: Spillage of chemical, during off-loading, de-canting, leakage from storage and process pipework, accidental spillage.

Air: VOC/odour release from spillage or vapour displacement, dust.

Waste: Pallets, drums, off-specification materials, out-of-date product, spillages.

Energy: Not significant

Accidents: Spillage of chemicals during handling operations. Leakage and containment failure of pipe work, drums, tanks etc. Fire within the storage and handling areas.

Noise: Vehicles and delivery operations may cause noise disturbance, especially if close to the site boundary. Blowing into silos from road tankers can create noise, disturbances such as pump noise, resonation in pipe work.

BAT	
1	The operator should ensure that deliveries are carried out in such a way so as to minimise noise, spillage, leaks and emissions.
2	Storage areas for solvents and treatment chemicals should be under cover and protected from the elements to avoid or minimise environmental impact, except where stored materials are in suitable weather proof containers.
3	Storage areas for solvents and treatment chemicals should be hard surfaced and contained or bunded. The containment area or bund can incorporate the treatment vessel area depending on site layout etc or be a separate dedicated area.
4	Bulk storage tanks for chemicals and solvent-containing liquids should wherever practicable be back vented to the delivery tank during filling. Where this is impracticable, for example: due to long pipe runs, back pressure, or contractual agreements over deliveries, then, displaced air vents should be sited in such a way as to prevent the arising of offensive odour beyond the site boundary
5	Bulk storage tanks for solvent storage should normally be light coloured, in order to reduce thermal increase as a resulting from sunlight. (planning restrictions may apply).
6	All new static bulk solvent storage tanks containing solvent with a composite vapour pressure that is likely to exceed 0.4kPa at 20^{o}C (293K) should be fitted with pressure vacuum relief valves. Pressure vacuum relief valves should be examined at a minimum of at least once every six months for signs of corrosion, contamination, incorrect seating and be cleaned and/or corrected as required
7	Delivery connections to bulk storage tanks should be located within a bunded/contained area, fixed and locked when not in use.
8	All fixed storage tanks should be fitted with audible and/ or visual high-level alarms or volume indicators to warn of overfilling. Where practicable in relation to the viscosity of the material being handled or pumping system used, the filling systems should be interlocked to the alarm system to prevent overfilling.
9	Deliveries to bulk storage tanks should be supervised by trained personnel to avoid potential accidents and spillage.
10	Solvent and biocide containing materials should be stored in closed storage containers.
11	The storage, handling and use of flammable materials should be in accordance with HSE requirements, in order to prevent accidents that may have environmental consequences

Treatment

5.13 Wood is loaded in packs or as individual large items onto plant loading systems which are used to transfer the wood into and out of the treatment vessels.

5.14 Packs are sloped when stacked with appropriate spacers to preclude capillary retention between surfaces. Shaped profiles are positioned so as to avoid traps that collect free solution. Flat metal areas are eliminated from the plant loading system construction as are traps that may collect free solution.

5.15 Packs/pieces are either secured to the plant loading systems using a restraint such as chains or tension straps to prevent lifting during treatment or are restrained by use of containment e.g. cages.

5.16 Plant loading systems make use of rails to allow wood packs to be driven into the treatment vessel by use of a variety of external drivers such as loading tractors, pulley systems etc. Automatic drivers/loading systems are used in some newer sites

5.17 The treatment plant normally consists of two main components. The treatment vessel that may be a cylindrical or rectangular pressure vessel and normally one or more storage vessels; one is the working vessel which holds the preservative to flood the treatment vessel and the other is the bulk tank which is used to accept delivery of new preservative and to replenish the working vessel.

5.18 Wood loaded plant loading systems are driven into the vessel and the door is closed and securely locked. The treatment vessel door incorporates safety devices to prevent the process starting until the door is fully closed and locked and to prevent it being opened until all preservative is removed to storage.

5.19 The process, which is generally referred to as a vacuum process, is carried out as follows: There are six main stages, though Stage 1 may be omitted:

1) Initial vacuum - an initial vacuum is used to take air out of the wood. The length of this vacuum period and level used vary according to the specification being followed. The amount of air removed will affect the final uptake and penetration of preservative. To control retentions some processes run without applying an initial vacuum.

2) Flooding - the preservative solution is transferred from the working vessel to the treatment vessel. If applied, the vacuum is maintained during transfer.

3) Pressure Period - once the treatment vessel is full the vacuum is released and, unless atmospheric pressure only is to be used, hydraulic pressure is applied using a pump. The wood is held in the preservative for a period of time.

4) Initial Drain - at the end of the pressure period the preservative is transferred back to the working vessel.

5) Final Vacuum - a final vacuum is applied to the wood both to remove any excess preservative from the surface layer of the wood and to reduce dripping of the treated wood at the end of the process. As this vacuum is released, air moves back into the vessel and into the surface cells of the wood, carrying with it some of the residual preservative fluid on the wood surface. This stage may be replaced or augmented when using steam conditioning to initiate drying of the treated wood.

6) Final Drain - during the final vacuum, the preservative collected in the treatment vessel is pumped back into the working vessel. Where an organic solvent-based preservative is used fresh air is often drawn through the vessel before the wood is removed from the vessel remove vapour from the working area around the door to minimise operator exposure.

5.20 On completion of the treatment cycle the pressure vessel door will be unlocked by the process management system which will allow the door to be opened and plant loading systems to be driven / pulled from the treatment vessel.

5.21 Packs may then be removed from the plant loading systems to allow further drying or where appropriate the plant loading systems and packs can be stored on a fully impermeable contained and drained post treatment drying area to allow further drying.

Drying process

5.22 The treatment process is followed by air drying through evaporation or through the use of forced drying. Drying occurs on a fully covered, impermeable, contained and drained post treatment drying area. Where packs undergo drying as the final stage of treatment such as in steam fixation systems then the need for coverage may be removed.

5.23 Post treatment drying areas require to be covered as the volumes of contaminated water which would be generated would be far in excess of the production water usage on site leading to significant costs in relation to waste handling infrastructure and off-site treatment.

5.24 Packs are defined as dry before being moved from the post treatment drying area for onward transit to storage or external sales.

5.25 Definition of dry is a significant issue for potential contamination of storage areas and subsequently groundwater. To prevent packs being moved when they still have the potential to drip treatment chemicals packs must be defined as dry prior to movement.

5.26 To be defined as dry, packs should be lifted by a mechanical lift such as a fork-lift truck and held suspended in the post treatment drying area for a minimum of 5 minutes to allow the packs to settle and compress which will release any fluid which is still held within the body of the pack. If no drip of treatment chemical form on or fall from the pack during this time then the pack is clear to be defined as dry and removed from the post treatment drying area.

5.27 If a treatment cycle load is made up of several identical packs which are treated and dried as a group then this group can be defined as dry by suspending one pack only from the group.

5.28 Treatment liquids and any surface water run-off is reclaimed from the post treatment drying area and added into the treatment system for re-use.

5.29 Vehicles which are used within the post treatment drying area have the potential to be heavily contaminated with treatment chemicals as the run-off of treatment chemicals from drying packs within the pack handling area can be significant. Such vehicles must remain within the treatment area to prevent tracking of treatment chemicals onto permeable areas or areas with open drainage.

5.30 If production vehicles are to be removed from the treatment area for service or repair the bodies and wheels are washed to remove all traces of treatment chemical prior to removal. Cleaning water is drained into the treatment system for re-use.

Environmental impact

Water: Potential for significant impact. Water use associated with water-borne fungicidal & biocidal coatings is evaporated to atmosphere at this stage or is allowed to drip onto an impermeable post treatment drying area where the run-off is collected in a closed drainage system.

Land: Potential for significant releases. Biocides and fungicides in aqueous form may "drip" to land if not contained.

Air: VOC from organic solvent evaporation.

Waste: No significant impact.

Energy: Principle energy use on site

Accidents: Fire from ignition of vapour

Noise: Potential noise from vehicle movements.

BAT	
12	The treatment area which consists of the treatment vessels, working vessels, associated pipework, treatment vessel loading area consisting of the full rail line and post treatment drying area should be under cover and protected from the elements. Surface water from the roof area should be drained to either a drainage system to be used as make up water within the process or to a sealed surface water drainage system. Where forced drying such as steam fixation is employed as part of the treatment cycle coverage of the loading rail lines is not required.
13	The treatment area should have an impermeable surface, spill containment kerbs, sealed construction joints and a bunded exterior to contain treatment solution. The condition of the impervious surface should be checked regularly and the intended maintenance recorded.
14	Wood packs should be stacked to maximise free draining of treatment solution: - Packs should be sloped in traditional horizontal treatment vessels, tilting treatment vessels and vessels which use techniques such as steam fixation may use horizontal packs.
15	Wood should be separated in packs by spacers as per the site pinning plan to allow free movement of air during drying and to minimise capillary retention between surfaces.
16	Shaped profiles should be positioned to prevent ponding of treatment solution.
17	Plant loading systems should not be constructed with flat areas or trap areas where treatment solution may pond.
18	Wood packs/pieces should be secured to prevent "wood lift" during treatment.
19	Treatment vessels should be filled with wood packs/pieces to be treated to an optimum capacity to maximise treatment cycle efficiency.
20	The treatment vessel should be locked shut and sealed once the wood pack/plant loading system is loaded and before treatment takes place.

21	Process controls should prevent the operation of the treatment vessel unless the vessel is locked and sealed.
22	Process controls should prevent the treatment vessel from opening prior to completion of the treatment cycle and full removal back to storage of all treatment solution from the treatment vessel.
23	Process controls should include a display to show if liquid is present in the treatment vessel.
24	Where the treatment vessel door requires to be opened in an emergency situation the door should be fitted with a catch-lock to prevent the release of fluid.
25	Treatment vessels are typically fitted with two safety relief valves, these valves should be designed to ensure that any discharge is directed to a tank of sufficient capacity.
26	Plant loading systems should be removed from the treatment vessel by drawing back along a rail system; this rail system should be built on an impermeable surface and all treatment solution draining from the plant loading systems and attached packs should be directed back into the treatment plant system for re-use in the process.
27	Packs may remain on plant loading systems to complete drying or they may be removed and placed in a post treatment drying area. All pack movements should occur on an impermeable surface which is drained back to a holding vessel by use of a drainage system.
28	Vehicles used to move packs within the treatment area will become contaminated with treatment solution and should remain in the treatment area.
29	Vehicles in the treatment area must be cleaned in the treatment area prior to egress for service or repair. Cleaning water should be added to the treatment system.
30	The drainage systems related to the treatment operation should be recorded on a clear diagrammatic record and should be inspected on an annual basis to prove the continuing efficacy of the system.
31	Wood packs should remain on the post treatment drying area until such times as the packs are defined as dry.
32	To be defined as dry a pack shall be lifted by mechanical means and shall be suspended above the post treatment drying area for a minimum of 5 minutes. The pack should not form drips or drip treatment solution during this period. Packs which make up a single charge and which are made up of the same wood type and form can be deemed dry as a group after suspension testing of a single sample pack from the group.
33	Operators should develop a reporting system which records the movement of a pack onto and off of the post treatment drying area this report should include:- a specific pack identifier, date and time of addition and removal, weather conditions and signature of person responsible for accepting dry condition.
34	Once defined as dry, packs should be removed from the post treatment drying area.
35	Motors on the treatment vessel should be fitted with variable speed drives controls or use stop drives to minimise energy usage wherever possible.

Process Vessel Cleaning

5.31 Process vessel cleaning is a necessary stage in the treatment process. Process vessels and associated connecting pipes, pumps and filters can only be cleaned in

situ. The range of cleaning equipment and method used will vary according to the shape of the tanks, the treatment systems concerned, the degree of cleanliness to be achieved and quality. Fixed vessels are often cleaned using static spray heads that can be fixed into position over the top of the vessel or through a cleaning port. Usually organic solvent is used in such systems as the cleaning media and is sprayed at low pressure into the top of the vessel. Other cleaning methods may involve physical techniques using brushes instead of spray heads, and manual cleaning performed from outside or directly inside the tank. Cleaning media other than solvent may include caustic solutions, water-based cleaners and abrasive impact techniques using inert particles.

5.32 Pipe lines connecting tanks are normally flushed to clean.

5.33 Often, it is difficult to find one machine that can clean all sizes and shapes of portable tanks and invariably, some manual cleaning will be carried out, normally the external shell of the tank and valves.

5.34 Filters are cleaned either in situ as part of the pipe flushing/pigging process or as an open manual process under local or general exhaust ventilation. The method of cleaning will depend on the type of filter. Filter cleaning can be avoided by using disposable filters, which are available for certain equipment and are suitable for certain products.

Environmental impact

Water: Water may be used for cleaning vessels and emitted to effluent.

Land: No significant releases.

Air: VOC from organic solvent transfer, mixing and blending operations.

Waste: Generated from rejected material, cleaning organic solvents, filters.

Energy: Associated with disperser, pump and air handling equipment. Generally process specific. May be < 10% of site usage.

Accidents: Spillage of chemicals, leakage and containment failure of pipe work, drums, tanks, etc. Fire within organic solvent handling area.

Noise: Not significant

BAT	
36	Cleaning water should be minimised by using rotary spray nozzle heads or similar means and reused where technically possible.
37	Where materials that are potentially harmful to the environment may be present in waste water, measures should be taken to prevent them from entering the water circuit. Water which has been in contact with treatment chemicals should be used as “make-up water”.

Emissions control

Point source emissions to air

5.35 The nature and source of the emissions to air expected from each activity are given in previous sections. In general they comprise:

- VOC from most surface treatment and coating operations;
- Particulate matter from the handling of powders or dusty materials;
- "Sticky" particulate matter from creosote operations;
- Odorous compounds from VOC and non-VOC compounds and the thermal breakdown of compounds during drying operations;

Dispersion and dilution of stack emissions

5.36 The basis upon which stack heights are calculated using HMIP Technical Guidance Note D1 is that pollutants are dispersed and diluted in the atmosphere to ensure that they ground at concentrations that are harmless under the theoretical conditions of the D1 model. The emission limit in this sector note should be used as the basis for chimney height calculation. The chimney height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure. It is necessary that the assessment also takes into account the relevant air quality standards that apply for the emitted pollutants.

5.37 The calculation procedure of D1 is usually used to calculate the required chimney height but alternative dispersion models may be used in agreement with the regulator. D1 relies upon the unimpeded vertical emission of the pollutant. A cap or other restriction over the stack impedes the vertical emission and hinders dispersion. For this reason where dispersion is required such flow impeders should not be used. A cone may sometimes be useful to increase the efflux velocity and achieve greater dispersion.

5.38 An operator may chose to meet a tighter emission limit in order to reduce the required chimney height.

5.39 Liquid condensation on internal surfaces of chimney flues and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission.

5.40 Adequate insulation should be provided to minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint

5.41 Unacceptable emissions of droplets could possibly occur as a result of entrainment from wet abatement plant where the linear velocity within the associated ductwork exceeds 9 m/s. The use of mist eliminators reduces the potential for droplet emissions.

5.42 Where a linear velocity of 9 m/s is exceeded in the ductwork of existing wet abatement plant, the linear velocity should be reduced, subject to health and safety considerations, to ensure that droplet fallout does not occur.

5.43 The dispersion from all emission points to air can be impaired by low exit velocity at the point of discharge, or deflection of the discharge:

5.44 Chimney flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.

5.45 A minimum discharge velocity should be required in order to prevent the discharged plume being affected by aerodynamic down wash.

5.46 Emission points to air should not be fitted with any restriction at the final opening such as a plate, cap or cowl, with the exception of a cone which may be necessary to increase the exit velocity of the emissions.

BAT	
All releases to air	
The operator should:	
38	Ensure that all operations which generate emissions to air are contained and adequately extracted to suitable abatement plant, where this is necessary to meet specified emission limit values.
39	Ensure that potential emissions are recovered and reused where possible.
40	Ensure that emissions from combustion processes in normal operation are free from visible smoke and in any case do not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:2009.
41	Ensure that emissions take place from the minimum practicable number of chimneys. This is particularly important when new plants are being designed or when changes are being made to existing processes. If practicable a multi-flue stack should be used.
42	Ensure that vent and chimney heights are sufficient to ensure adequate dispersion under all normal operating conditions.
43	Ensure that the minimum vent height is 3 metres above roof ridge height of any building within a distance of 5 times the uncorrected vent height and in no circumstances should it be less than 8 metres above ground level.
44	Be able to demonstrate to the regulator that all reasonably practicable steps are taken during start-up and shutdown, and changes of fuel or combustion load in order to minimise emissions.
45	Investigate the cause and nature of any persistent visible emissions and provide a report to the regulator.
46	Ensure that emissions of water vapour are free from droplet fallout.
47	Ensure that liquid entrainment in the duct of wet abatement, leading to droplet fallout, does not occur as a result of the linear flow rate within the duct exceeding 9 m/s.
48	Ensure that flues and ductwork are cleaned to prevent accumulation of materials, as part of the routine maintenance programme.
49	Normally the discharge of exhaust gases through a stack takes place at constant volume. When this occurs stacks should achieve a minimum efflux velocity of between 10 - 15 m/sec unless dispersion modelling allows a lower velocity to achieve air quality standards. Where the discharge volume varies then the design of the stack should be optimised around the most frequent emission rate.
50	Ensure that stacks are not fitted with any restriction at the final opening such as a plate, cap or cowl, with the exception of a cone which may be necessary to increase the exit velocity of the emissions
51	Where possible, ductwork should be sufficiently lagged to prevent condensation of liquids within the duct in particular solvents.
52	Combustion processes should use low NOx burners.

Point source emissions to surface water and sewer

5.47 In general, wastewater can arise from storm water, from accidental emissions of raw materials, products or waste materials and from fire fighting.

5.48 The following general principles should be applied in sequence to control emissions to water:

- water use should be optimised and wastewater re-used or recycled
- the risk of contamination of process or surface water should be minimised

Off site effluent treatment

5.49 Where an operator discharges to a Sewage Treatment Works via sewer, the sewerage undertaker is a statutory consultee and must be sent a copy of the application. The STW operator is likely to confirm the levels of pollutants (considering levels specified in the trade effluent consent) that the sewer is able to take.

5.50 In all cases the effluent discharged from the installation must not give rise to a potential breach of an EQS or EAL for the final receiving water, when taken with compliance with any water company permit. In a significant number of cases the regulator finds that the STW operator's discharge consent and the intent to protect watercourses are closely aligned. Where they are aligned and there is a simple discharge, it is common practice just to rely on the consent and not to replicate limits in permit conditions.

BAT	
The operator should ensure that:	
53	All emissions are controlled, as a minimum, to avoid a breach of water quality standards (Calculations and/or modelling to demonstrate this may be required by the regulator).
54	Run-off from the installation should be controlled and managed and where necessary (given the nature of the run-off) treated before discharge in a suitable effluent treatment plant
55	All interceptors: • are impermeable • are subject to visual inspection and any contamination removed at a frequency agreed with the regulator • have an annual maintenance inspection; prior to inspection all contents should be removed
56	Procedures for dealing with the discharges from bunds should be in place.
57	Process effluent is kept separate from surface drainage unless agreed with the regulator.

Point source emissions to groundwater

5.51 There should be no intentional point source emissions of List I and List II substances as defined by the Water Framework Directive to groundwater from the surface treatment sector.

BAT	
58	There should be no intentional point source emissions of List I and List II substances as defined by the Water Framework Directive to groundwater

Fugitive emissions to air

5.52 Common sources of fugitive emissions are VOC and particulate matter from:

- handling, mixing, use and storage of organic solvent-borne surface cleaners and organic solvents;
- storage areas (e.g. bays, stockpiles etc.);
- the loading and unloading of transport containers;
- transferring material from one vessel to another (e.g. mixing vessels or storage vessels, silos);
- pipework and ductwork systems (e.g. pumps, valves, flanges, catchpots, drains, inspection hatches etc.);
- accidental loss of containment from failed plant and equipment including leakage e.g. from bunds and drains.

5.53 Where there are opportunities for reductions in fugitive emissions, the permit may require an updated record of fugitive emissions to be submitted on a regular basis, and normally at least once per year.

BAT	
59	Operations should be controlled to minimise fugitive emissions.
60	Where dusty materials are handled, dust should normally be controlled by covering of skips and vessels, using enclosed conveyors, spraying water on conveyors, minimising drops and by avoiding outdoor or uncovered stockpiles.
61	**For VOC** where the operator uses the Emission and Fugitive limits or the Total Emission Limit Value for compliance the Fugitive VOC Emissions must be determined in accordance with the Solvent Management Plan. Once completed, it need not be done again until the equipment is modified in such a way as to affect the potential fugitive release of VOCs.
62	When transferring volatile liquids, one or more of the following techniques should be employed - subsurface filling via filling pipes extended to the bottom of the container, the use of vapour balance lines that transfer the vapour from the container being filled to the one being emptied, or an enclosed system with extraction to suitable abatement plant where abatement is necessary to meet the emission limits.
63	Vent systems should be chosen to minimise breathing emissions (e.g. pressure/vacuum valves) and, where relevant, should be fitted with knock-out pots and appropriate abatement equipment.

Fugitive emissions to surface water, sewer and groundwater

5.54 The operator should have a clear diagrammatic record of the routing of all installation drainage for surface water and process effluent, to include subsurface pipework, the position of any sumps and storage vessels including the type and broad location of the receiving environment.

5.55 An inspection and maintenance programme should be established for all subsurface structures. Inspection frequencies and test methods should be chosen to prevent pollution by minimising leaks from subsurface pipework, sumps and storage vessels, having regard to the risk factors below.

5.56 The minimum inspection frequency should normally be no less than once every five years for yard drainage (i.e. rainwater from roofs, hardstanding etc) and no less than once every year for treatment areas. The precise choice of inspection frequency and the sophistication of the method should be guided by the level of risk presented but a likely maximum frequency may be once per annum.

5.57 Examples of inspection and test methods are pressure tests, leak tests, material thickness checks, and CCTV survey. Using secondary containment and/or leakage detection can serve to reduce the inspection frequency to the minimum quoted.

5.58 The likely risk to the environment from drainage systems is dependant on the following factors:

- nature and concentration of contaminants in the water transferred in the drainage systems
- volume of water transferred
- vulnerability of the groundwater in the locality
- proximity to surface waters.

5.59 For yard drainage, it is likely that the minimum inspection frequency (normally no less than once every five years) and least complex inspection methods will suffice irrespective of volume of water, vulnerability of local groundwater and proximity to surface waters.

5.60 The vulnerability is defined by the nature of the subsurface, and is mapped for England and Wales in a series of Groundwater Vulnerability maps. An additional measure of risk is whether the installation sits within a Groundwater Source Protection Zone (GPZs) as defined by the Environment Agency's Groundwater Protection Policy. GPZs help to identify areas, which are particularly sensitive to groundwater pollution because of their proximity to an important water supply.

5.61 Operational areas should be equipped with an impervious surface, spill containment kerbs, sealed construction joints, and connection to a sealed drainage system unless the operator fully justifies that this is not necessary. Management controls such as recording the design and condition of the surfacing (capacities, thicknesses, falls, material, permeability, strength/reinforcement, and resistance to chemical attack), and regular inspections and maintenance should be used.

5.62 The operator should ensure that all tanks containing liquids whose spillage could be harmful to the environment are contained. Bunds should be impermeable and resistant to the stored materials, have no outlet (drains, soakaways etc) and drain to a blind collection point. Pipework should be routed within bunded areas with no penetration of contained surfaces. Bunds should be designed to have a holding capacity of at least 110% of the largest tank and be located more than 10m from watercourses and 50m from drinking water boreholes.

5.63 It is good practice for bunds to be fitted with a high-level probe and an alarm as appropriate and are inspected regularly by the operator. Where practicable rainwater should be prevented from entering bunds, but any spills and rainwater accumulations should be removed as soon as possible.

5.64 All storage tanks should be fitted with high-level alarms or volume indicators to warn of overfilling. Where practicable the filling system should be interlocked to the alarm system of prevent overfilling. Tanks should have delivery connections located within a bunded area, fixed and locked when not in use and have their integrity inspected, recorded and documented, particularly where corrosive substances are involved. These inspections should be included in the maintenance schedule.

5.65 Operators should assess the pollution risks posed by the storage of solvents. In addition to the above preventative measures, solvent storage areas should be away from surface water sources, surface water drains, soakaways, drinking water boreholes or sumps.

5.66 For further information, a Code of Practice on the use and storage of solvents is available on the Defra website

BAT	
64	The operator should have a clear diagrammatic record of the routing of all installation drains, subsurface pipework, sumps and storage vessels including the type and broad location of the receiving environment.
65	The operator should identify the potential risk to the environment from drainage systems recorded by BAT 64 and should devise an inspection and maintenance programme having regard to the nature and volume of waste waters, groundwater vulnerability and proximity of drainage systems to surface waters.
66	Oil and solid interceptors should be used if necessary for the drainage of open storage areas.
67	All sumps should be impermeable and resistant to stored materials.

68	All liquid storage tanks should be located within bunds that are designed and constructed to appropriate standards ensuring that the volume is more than 110% of the largest tank or 25 per cent of the total volume you are likely to store, whichever is greater.
69	Storage tanks should be fitted with high-level alarms or volume indicators to warn of overfilling and where practicable the filling system should be interlocked to the alarm system to prevent overfilling. Delivery connections should be located within a bunded area, fixed and locked when not in use.
70	All tanks bunds and sumps should be subject to regular visual inspection, as agreed with the regulator, and placed on a preventative maintenance programme. The contents of bunds and sumps should be pumped out or otherwise removed as soon as is practicable after checking for contamination
71	The operator should assess the pollution risks posed by the storage of solvents and devise control measures to minimise the pollution risk.
72	For VOC where the operator uses the Emission and Fugitive limits or the Total Emission Limit Value for compliance the Fugitive VOC Emissions must be determined in accordance with the Solvent Management Plan. Once completed, it need not be done again until the equipment is modified in such a way as to effect the potential fugitive release of VOCs.

Odour

5.67 The potential for odorous emissions varies according to the types of materials used, the operations carried out within the installation and the techniques used to control potential emissions. Both VOC and non-VOC compounds may give rise to odorous emissions as a result of handling storage and use within the installation, in particular thermal breakdown of compounds during drying may lead to odorous emissions.

5.68 Chapter 17 of the General Guidance Manual provides guidance on controlling odour from installations and the information required in an application. Where odour is identified as a potential problem then the requirements of the following paragraphs should be implemented.

Assessment

5.69 Operators should assess the likely sources of odour and carry out olfactory assessments at the site boundary. Odour control should be carried out in the following order of priority:

- prevention – substitution
- minimisation by replacement of odorous materials with those of no or lower odour potential.
- containment and extraction
- abatement

5.70 Implementation of the best available techniques and the emission limit values and provisions of this note should ensure that offensive odours are not perceived beyond the site boundary. It may be necessary to include additional controls to avoid offensive odours, for example where local meteorological conditions frequently lead to poor dispersion conditions.

5.71 The overall aim should be that all emissions are free from offensive odour outside the site boundary, as perceived by the regulator. The locality will influence the assessment of the potential for odour impact for example local meteorological conditions (all predicted wind directions and weather conditions) which may lead to poor dispersion conditions. Where the site has a low odour impact due to its remoteness from sensitive receptors, the escape of offensive odour beyond the installation would be unlikely to cause harm. In these circumstances, operations should still be optimised as described below.

Prevention

5.72 Operators should seek to prevent and minimise odours from the installation by prevention i.e. by switching to lower solvent-based materials, or to solvents with a lower odour potential.

Minimisation

5.73 Where odour generation is not preventable, odours should be minimised at source and/or contained with effective treatment prior to discharge.

Containment, Extraction and Abatement

5.74 In the case of existing processes where odour abatement equipment has been installed, the regulator should consider permitting the use of the existing equipment provided that emissions from the equipment do not result in offensive odours beyond the installation boundary. The regulator should still require that the available equipment is optimised for odour removal and should establish the odour abatement efficiency based upon operating data. Where emissions from the odour abatement equipment are still leading to offensive odours beyond the process boundary, the equipment should be upgraded.

5.75 For complex installations, for example where there are a number of potential sources of odorous releases or where there is an extensive programme of improvements to bring odour under control, an odour management plan should be maintained. The regulator may incorporate the odour management plan in the permit.

BAT	
73	Operators should conduct odour assessments to determine whether emissions result in offensive odours at or beyond the installation boundary.
74	If operations are identified as resulting in offensive odour, operators should devise an odour control programme of improvements and maintain an odour management plan.

Management

5.76 Within IED, an effective system of management is a key technique for ensuring that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis.

5.77 An effective Environmental Management System (EMS) will help the operator to maintain compliance with regulatory requirements and to manage other significant environmental impacts. An EMS includes an environmental policy and programme which:

- includes a commitment to continual improvement and prevention of pollution;
- includes a commitment to comply with relevant legislation and other requirements to which the organisation subscribes; and
- identifies, sets, monitors and reviews environmental objectives and key performance indicators independently of the Permit.

5.78 The operator should have demonstrable procedures (e.g. written instructions) which incorporate environmental considerations into process control, design, construction and review of new facilities and other capital projects (including provision for their decommissioning), capital approval and purchasing policy.

5.79 Audits should be carried out, at least annually, to check that all activities are being carried out in conformity with the above requirements. Reporting should be carried out annually on environmental performance, objectives and targets, and future planned improvements. Ideally, these should be published environmental statements.

Operations and maintenance

5.80 Maintenance - it is good practice to ensure:

- effective preventative maintenance on all aspects of the process the failure of which could impact on the environment
- clear written maintenance instructions for all relevant items are developed and maintained
- a method of reviewing maintenance needs, with demonstrable evidence that this process takes place

5.81 Training – all relevant (including operational) staff should be trained in the regulatory implications of the permit, all potential environmental impacts (under normal and abnormal circumstances). Training should also include the procedures for dealing with a breach of the permit conditions, prevention of accidental emissions and action to be taken when accidental emissions occur and also in all operating procedures.

5.82 Responding to problems - The regulator needs to be notified about certain events and expects the operator to respond to problems, which may have an effect on emissions to the environment. Such problems may arise within the process itself or, for example, with the abatement.

5.83 Contractors on site - It is important to be aware that in complying with their permit, operators will be responsible for work undertaken by contractors. Operators are advised to provide instructions to contractors regarding protecting the environment whilst working on site.

BAT	
Environmental Management System	
75	Operators should use an effective Environmental Management System with policies and procedures for environmental compliance and improvements. Audits should be carried out against those procedures at regular intervals.
Operations and maintenance	
76	Effective operational and maintenance systems should be employed on all aspects of the installation whose failure could impact on the environment. Such systems should be reviewed and updated annually.
77	Environmentally critical process and abatement equipment (whose failure could impact on the environment) should be identified and listed. The regulator should be provided with a list of such equipment. For equipment referred to above: • Alarms or other warning systems should be provided, which indicate equipment malfunction or breakdown; • Such warning systems should be maintained and checked to ensure continued correct operation, in accordance with the manufacturer's recommendations; • Essential spares and consumables for such equipment should be held on site or be available at short notice from suppliers, so that plant breakdown can be rectified rapidly.
78	Records of breakdowns should be kept and analysed by the operator in order to eliminate common failure modes.
Competence and training	
79	A competent person(s) should be appointed to liaise with the regulator and the public with regard to complaints. The regulator should be informed of the designated individual(s).
80	A formal structure should be provided to clarify the extent of each level of employee's responsibility with regard to the control of the process and its environmental impacts. This structure should be prominently displayed on the company within the process building at all times. Alternatively, there must be a prominent notice referring all relevant employees to where the information can be found.
81	Personnel at all levels should be given training and instruction sufficient to fulfil their designated duties under the above structure. Details of such training and instruction should be entered into an appropriate record and be made available for inspection by the regulator.
82	The potential environmental risks posed by the work of contractors should be assessed and instructions provided to contractors about protecting the environment while working on site.
Accidents/incidents/non-conformance	
83	There should be written procedures for investigating incidents, (and near misses) which may affect the environment, including identifying suitable corrective action and following up.

Raw Materials

5.84 This section covers the use of raw materials and water and the techniques for optimising their use and minimising their impact by selection (Energy and fuels are covered under Energy).

5.85 As a general principal the operator will need to demonstrate the measures taken to:

- reduce the use of chemicals and other materials;
- substitute with materials presenting lower risks to the environment;
- understand the fate of by-products and contaminants and their environmental impact.

Raw materials selection

5.86 Raw materials used in the wood products preservation sector may include solvent preservatives, creosote and water based preservatives. In all cases, the selection of the product will be determined by a combination of factors, including the specific application methods and its fitness for purpose.

5.87 The availability and suitability of low organic solvent or organic solvent free products shall be regularly reviewed.

5.88 Substances or mixtures classified as carcinogens, mutagens, or toxic to reproduction, are assigned or need to carry the hazard statement designations H340, H350, H350i, H360D, or H360F, shall be replaced, as far as possible by less harmful substances or mixtures within the shortest possible time.

5.89 The criteria in Table 5.1 should be considered when selecting raw materials.

Table 5.1 - Selection of raw materials	
Raw Material	**Selection Criteria**
Solvents	The vapour pressure, flammability, odour, Classification under the Montreal Protocol, CHIP risk phrase / hazard statement classification
Water	Identify most sustainable source (consider recycled sources).
Fuel oils	Sulphur content should be minimised. The maximum sulphur content of heavy fuel oil should be 1%.
Solvent usage	Where solvent based degreasing is necessary then, in particular for chlorinated solvents, the requirements of IED should be met.

5.90 When selecting alternative raw materials, operators should ensure that decisions are taken on the basis of their environmental impact, whilst not compromising process quality and product integrity.

BAT	
84	The operator should adopt procedures to control the specification of those types of raw materials with the main potential for environmental impact, such as the preservatives used in the process in order to minimise any such impact. An annual review of alternative raw materials should be carried out with regard to environmental impact.
85	Substances or mixtures which are assigned or need to carry hazard statement designations H340, H350, H350i, H360D, or H360F should be replaced, as far as possible by less harmful substances and mixtures within the shortest possible time.
86	A programme to monitor and record the consumption of preservative against product produced should be used to optimise the amount of preservative used

Waste minimisation (optimising the use of raw materials)

5.91 Waste minimisation can be defined simply as: “a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste”.

5.92 A variety of techniques can be classified under the term waste minimisation and they range from basic housekeeping techniques through statistical measurement techniques, to the application of clean technologies.

5.93 Key operational features of waste minimisation should be:

- the ongoing identification and implementation of waste prevention opportunities
- the active participation and commitment of staff at all levels including, for example, staff suggestion schemes
- monitoring of materials' usage and reporting against key performance measures or benchmarks

5.94 Using this information, opportunities for waste reduction, changes in process and improved efficiency should be generated and assessed, and an action plan prepared for the implementation of improvements.

5.95 The use and fate of all materials should be mapped onto a process flow diagram using data from the raw materials inventory and other company data as appropriate. Data should be incorporated for each principal stage of the operation in order to construct a mass balance for the installation. The mass balance can then be used to identify opportunities for improvements.

5.96 Monitoring and mapping material usage in this way can be carried out to determine benchmarks in terms of the amount of any given raw material used per tonne of product manufactured. Assessment against benchmarks can reveal whether the process is being maintained "in control" or to trigger investigations in to why raw material usage is increasing.

5.97 The regulator should enquire as to sector specific benchmarks that may be typically used for process control and waste minimisation.

5.98 There should be continuous movement towards more Sustainable Consumption and Production (i.e. doing more for less) as laid out in Government Guidance " Changing Patterns - UK Government Framework for Sustainable Consumption and Production" Section 3.3 of the guidance identifies advice and funding programmes available to achieve more sustainable production practices. The National Industrial Symbiosis Programme shares information across all industrial sectors to produce guidance and case studies for resource efficiency.

BAT	
87	The operator should record materials usage and waste generation in order to establish internal benchmarks. Assessments should be made against internal benchmarks to maintain and improve resource efficiency.
88	The operator should carry out a waste minimisation audit at least as frequently as the permit review period.
89	If an audit has not been carried out in the 2 years prior to submission of the application it should be completed within 18 months of the issue of the first PPC permit. The methodology used and an action plan for optimising the use of raw materials should be submitted to the regulator within 2 months of completion of the audit.
90	Specific improvements resulting from the recommendations of audits should be carried out within a timescale approved by the regulator

Water use

5.99 The amount of water used in the chemical treatment of wood varies depending on the preservative used but may be significant for users of water based preservatives.

5.100 For significant users water use should be minimised within the BAT criteria for the prevention or reduction of emissions and be commensurate with the prudent use of water as a natural resource.

5.101 Reducing water use may be a valid environmental and/or economic aim in itself, perhaps because of local supply constraints. However in the case of water based preservatives it is likely that scavenging of water arising from roofs and yards will aid the water use within the site.

5.102 The use of a simple mass balance for water use may help to reveal where reductions or reclamations can be made.

5.103 The following general principals should be applied in sequence to reduce emissions to water:

- water-efficient techniques should be used where possible
- water should be recycled within the process from which it issues, treating it first if necessary.

5.104 The volumes of water used by an installation should normally be metered so that water efficiency audits can be carried out and benchmarks can be set for optimal efficiency. In addition, sub-processes that are principal water users should be metered to optimise water usage at individual process plant.

BAT	
91	The operator should carry out a regular review of water use (water efficiency audit) at least as frequently as the permit review period. If an audit has not been carried out in the 2 years prior to submission of the application it should be completed within 24 months of the issue of the first PPC permit.
92	Using information from the water efficiency audit, opportunities for reduction in water use should be assessed and, where appropriate, should be carried out in accordance with a timescale approved by the regulator.
93	Information from audits should be used to establish benchmarks. Operators should keep records of such benchmarks and make measurement against them to reveal whether the process is being maintained "in control" or to track improvements.
94	The volume of mains and abstracted water used in the activities should be directly measured when the installation is operating under normal production conditions for a sufficient period to determine the base use of the activity. Thereafter, an annual exercise should be done to confirm the measurement. All measurements should be recorded and the records held on site.

Waste handling

5.105 Good segregation of materials is essential to facilitate opportunities for recovery, recycling and re-use and to maximise scope for good waste management.

5.106 The most important wastes are:

- Sludge's from degreasing and cleaning operations
- Sludge from effluent treatment processes
- Chemical and oil containers;
- General non-hazardous industrial waste

5.107 Most organic solvent and organic solvent contaminated wastes can be beneficially re-used by third parties especially if some degree of segregation is carried out to prevent unsuitable materials contaminating the waste

BAT	
95	The operator should produce an inventory of the quantity, nature, origin and where relevant, the destination, frequency of collection, mode of transport and treatment method of any waste which is disposed of or recovered.
96	Operators should segregate the main waste types
97	Operators should ensure that waste stored in containers that are durable for the substances stored and that incompatible waste types are kept separate.
98	Operators should: • Ensure that waste storage areas are clearly marked and signed, and that containers are clearly labelled. • Ensure that appropriate storage facilities are provided for substances that are flammable, sensitive to heat or light etc, and that incompatible waste types are kept separate. • Ensure that containers are stored with lids, caps and valves secured and in place. (This also applies to emptied containers.) • Ensure that procedures are in place to deal with damaged or leaking containers.
99	Identify the disposal route for all waste. This should be as close to the point of production as possible.
100	All reasonably practicable efforts should be made to minimise the amount of residual organic solvent bearing material left in drums and other containers after use. All organic solvent contaminated waste should be stored within closed containers.

Waste re-use, recovery, recycling or disposal

5.108 Waste should be re-used, recovered or recycled unless the regulator has accepted a satisfactory BAT justification for landfill disposal.

5.109 Table 5.2 summarises the routes currently taken by the various waste streams from a typical treatment site. Whether re-use, recovery or recycling is possible at a particular site will depend on the particular raw materials being used, and the methods of operation employed. The table reflects where recycling can be achieved when the appropriate combination of these factors is in place.

5.110 In the context of this note, recycling means the residue is returned to the process from where it has been produced, re-use means that the residue is used for another purpose.

5.111 Operators should seek to establish markets for the recovery or recycling of wastes generated within the installation.

Table 5.2 - Solid waste stream: routes currently taken	
Process Waste Stream	**Fate**
Solvents	• Recovery and reuse of solvent on site • Recovery and reuse of solvent off site
Metallic waste	Recycle
Wood, cardboard and paper	Segregated for off site re-use or recovery
Oil	Recovery off site

BAT	
101	The operator should carry out an annual review to demonstrate that the best environmental options are being used for dealing with the waste streams listed in Table 5.2 (above).
102	At a minimum of every two years, the operator should investigate potential markets for the recovery/re-use of wastes that are currently disposed of to landfill.

Energy

5.112 BAT for energy efficiency under the PPC Regulations will be satisfied provided the operator meets one of the following conditions:

- the operator meets the basic energy efficiency requirements below and is a participant to a Climate Change Agreement (CCA) with the Government or has EU ETS (European Union Emissions Trading System) commitments: or
- the operator meets the basic energy efficiency requirements below and the additional energy efficiency requirements

Basic energy efficiency requirements

5.113 The requirements of this section are basic, low cost, energy standards that apply whether or not a CCA is in force or the operator has EUETS commitments for the installation.

BAT	
103	The operator should produce a report annually on the energy consumption of the installation.
104	The operator should monitor energy flows and target areas for reduction which should be updated annually. ("Sankey" diagrams and energy balances would be useful as aids.)
105	The operator should ensure that all plant is operated and maintained to optimise the use and minimise the loss of energy.

Additional energy efficiency requirements

5.114 Within IED it is valid to consider both the emission of direct (heat and emissions from on-site generation) and indirect (emissions from a remote power station) pollution when considering options for energy efficiency.

BAT	
106	The following techniques should be considered and implemented where viable: • Heat recovery from different parts of the processes • Minimisation of water use and closed circulating water systems • Good insulation • Plant layout to reduce pumping distances • Phase optimisation of electronic control motors and fans • Optimised efficiency measures for combustion plant • Preventative maintenance programme targeting energy drops
107	The following techniques should be considered and implemented where viable: • Use of Combined Heat and Power (CHP) • Generation of energy from waste • Use of less polluting fuels

Accidents

5.115 For accident management, there are three particular components:

- identification of the hazards to the environment posed by the installation/activity
- assessment of the risks (hazard x probability) of accidents and their possible consequences
- implementation of measures to reduce the risks of accidents, and contingency plans for any accidents that occur

Identification of the hazards

5.116 In identifying the hazards particular areas to consider may include, but should not be limited to, the following:

- the use for flammable materials on site and potential sources of ignition static (due to poor materials selection, inadequate earth bonding);
- spark (due to incorrect electrical zoning, mechanical movement);
- heat (due to flames, radiant heat, friction);
- explosive atmospheres inside process equipment dusts and abatement plant;
- spillage and loss of containment of material.

Identification of the risks

5.117 The hazards having been identified, the process of assessing the risks should address the following:

- how likely is the particular event to occur (source frequency)?
- what substances are released and how much of each (risk evaluation of the event)?
- where do the released substances end up (emission prediction - what are the pathways and receptors)?
- what are the consequences (consequence assessment – what are the effects on the receptors)?
- what is the overall risk (determination of overall risk and its significance to the environment)?
- what can prevent or reduce the risk (risk management – measures to prevent accidents and/or reduce their environmental consequences)?

Measures to reduce the risks (identified by risk assessment)

5.118 Risk reduction can be achieved by process management controls and preventative measures. The following techniques will be relevant to most installations, although this is not an exhaustive list.

Process management controls

- process design, alarms, trips and other failsafe control techniques to ensure the safe operation of the plant
- security systems to prevent unauthorised access
- records of all incidents, near-misses, changes to procedures, abnormal events and findings of maintenance inspections and procedures to learn from such incidents
- personnel suitably trained in accident management
- guidance for specific accident scenarios
- procedures to ensure good communication among operations staff during shift changes and maintenance or other engineering work
- safe shutdown procedures
- established communication routes with relevant authorities and emergency services

Preventative measures

- procedures to ensure that the composition of the contents of a bund /sump is checked before treatment or disposal
- drainage sumps equipped with a high-level alarm with automatic pump to storage (not to discharge)
- high-level alarms etc. (which should not be routinely used as the primary method of level control)
- adequate standby plant or equipment maintained and tested to operational standards
- sufficient storage to contain process waters, site drainage waters, emergency firewater, chemically contaminated waters and spillages of chemicals, which should be routed where necessary, having regard to a site-specific assessment of risks, to the effluent system
- provision to contain surges and storm-water flows, which should be treated where necessary, having regard to a site-specific assessment of risks, before emission to controlled waters or sewer

- spill contingency procedures to minimise the risk of accidental emission of raw materials, products and waste materials and to prevent their entry into water
- procedures should be in place for checking and handling raw materials and wastes to ensure compatibility with other substances with which they may accidentally come into contact.
- suitable barriers to prevent damage to equipment from the movement of vehicles, as appropriate, having regard to a site-specific assessment of risks
- there should be procedures for responding to and learning from incidents, near-misses, etc.
- the roles and responsibilities of personnel involved in incident management should be formally specified.
- where indicated by the site-specific assessment of risks, containment or abatement for accidental emissions from vents and safety relief valves/bursting discs should be provided. Where this may be inadvisable on safety grounds, attention should be focused on reducing the probability of the emission.

BAT	
108	There should be written procedures for investigating incidents and near misses, including identifying suitable corrective action and following up.
109	The operator should maintain an accident management plan covering the matters listed above and to the satisfaction of the regulator. The plan should be available for inspection by the regulator.
110	In the case of abnormal emissions arising from an accident, such as a spillage for example, the operator should: Investigate immediately and undertake remedial action as soon as practicable promptly record the events and actions taken ensure the regulator is made aware without delay.
111	Specific conditions may need to be included within permits to prevent accidents. Examples of these are given below. • Suitable solvent containment and spillage equipment should be readily available in all solvent handling areas. • Adequate provision to contain potential liquid and solid spillage should be provided. • Appropriate precautions should be taken to prevent ignition of flammable materials. • All spillages should be cleared as soon as possible; solids by vacuum cleaning, wet methods, or other appropriate techniques may be used, however, dry sweeping of dusty spillages should not be permitted.
112	The handling and use of flammable and explosive materials should be carried out in accordance with the requirements of the Dangerous Substances and Explosive Atmosphere Regulations SI2776 2002

113	Areas where flammable organic solvents and organic solvent containing materials are handled or used should be suitably contained to minimise the potential spread for fire.
114	Electrical zoning and static protection should be provided in all areas where flammable organic solvents are stored used or handled.

Noise and Vibration

5.119 Within this section, “noise” should be taken to refer to noise and/or vibration as appropriate, detectable beyond the site boundary.

5.120 Noise surveys, measurement, investigation (which can involve detailed assessment of sound power levels for individual items of plant) or modelling may be necessary for either new or existing installations depending upon the potential for generating significant noise. Operators may have a noise management plan as part of their management system. Where an installation poses no risk of noise related environmental impact because the activities undertaken are inherently quiet or remote from receptors; these measures would not normally be required.

5.121 Following investigation of the impact of the installation, systems to minimise the environmental impact of the noisiest operations should be employed. The level of noise control required depends on the scale of operations and the proximity of operations to the public. Table 5.3 identifies the noisiest operations and the control measures that have been employed to mitigate problems.

Table 5.3 - Noise Mitigation Measures

Operation	Control measure
General	Relocate equipment
Fans, pumps and motors	Acoustic screens, enclosures and baffles Fitting silencers to avoid noise travelling along ducting Selection of less noisy engineering equipment Fitting resilient hangers for wall-mounted equipment
General	Fitting noise reducing flaps to outside doors Maintaining a closed doors policy Improving sound insulation of buildings Holes and openings closed off (use mechanical where necessary) Using flexible connections between vibrating and fixed plant Preventative maintenance programme e.g. equipment wear, bearings

BAT	
115	The operator should identify key plant and equipment (or operations) with the potential to give rise to significant noise and take such measures as are necessary by way of mitigation and maintenance of existing plant and equipment in order to minimise noise having regard to Table 5.3 above.

Monitoring

5.122 This section describes general monitoring and reporting requirements for emissions to all environmental media. Guidance is provided for the selection of the appropriate monitoring methodologies, frequency of monitoring, compliance assessment criteria and environmental monitoring.

Standards for monitoring equipment and procedures

5.123 The Environment Agency has introduced its Monitoring Certification Scheme (MCERTS) to improve the quality of monitoring data and to ensure that the instrumentation and methodologies employed for monitoring are fit for purpose.

5.124 Operators should ensure their monitoring arrangements comply with the requirements of MCERTS where available, e.g. using certified instruments and equipment, and using a registered stack testing organisation etc.

Sampling and analysis standards

5.125 Sampling analytical methods selected for compliance monitoring should normally be used in the following order of priority:

- Comité Européen de Normalisation (CEN)
- International Standardisation Organisation (ISO)
- British Standards Institution (BSI)
- United States Environmental Protection Agency (US EPA)
- American Society for Testing and Materials (ASTM)
- Deutsches Institut für Normung (DIN)
- Verein Deutcher Ingenieure (VDI)
- Association Française de Normalisation (AFNOR)

5.126 Guidance on standards for monitoring releases (to air, water and land) relevant to IED can be found on the Source Testing Association website

5.127 When selecting monitoring test methods, it is important to note that test methods are normally applicable to specific matrices (in relation to water) and concentrations of various pollutants (in relation to air). It is necessary to identify the most appropriate method in consideration of the hierarchy of methods. For example, if two methods are appropriate, the hierarchy is used to determine priority.

5.128 If in doubt the operator should consult the regulator.

Monitoring and sampling protocols

5.129 Where monitoring is needed the operator should devise a monitoring strategy to address the following:

- determinands to be monitored
- selection of monitoring points
- monitoring methods and procedures (selection of appropriate Standard Reference Methods)
- reference conditions and averaging periods
- measurement uncertainty of the proposed methods and the resultant overall uncertainty
- drift correction for continuous analysers
- quality assurance (QA) and quality control (QC) protocols, including accreditation and certification
- equipment calibration and maintenance, sample storage and chain of custody/audit trail
- reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information to the regulator

Monitoring frequency

5.130 The frequency of testing should be increased, for example, as part of the commissioning of new or substantially changed activities, or where the emission levels are near to or approach the emission limit.

5.131 Where non-continuous quantitative monitoring is required, the frequency may be varied. Where there is consistent compliance with emission limits, regulators may consider reducing the frequency. When determining 'consistent compliance' factors to consider include:

- the variability of monitoring results, for example, results which range from 15 - 45 mg/m^3, against an emission limit of 50 mg/m^3 might not qualify for a reduction in monitoring
- the margin between the results and the emission limit, for example, results which range from 45 - 50 mg/m^3 when the limit is 50 mg/m^3 might not qualify for a reduction in monitoring

5.132 Consistent compliance should be demonstrated using sequential results for example at least three or more monitoring exercises within two years, or two or more monitoring exercises in one year supported by continuous monitoring. Any significant process changes which might have affected the results should be taken into account.

5.133 Where effective surrogates are available they may be used to minimise monitoring costs.

5.134 Where monitoring shows that substances are not emitted in significant quantities, consideration can be given to a reduced monitoring frequency.

Monitoring emissions to air

5.135 The reference conditions of substances in releases to air from point sources are: temperature 273.15 K (0°C), pressure 101.3 kPa (1 atmosphere), measured wet, no correction for water vapour. To convert measured values to reference conditions, see Technical Guidance Note M2 for more information.

Monitoring emissions to water

5.136 The appropriateness of the monitoring requirements in Section 2 will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations, nature of the discharge and receiving water. For each release point the following information is required:

- the specific volume flow from the process to sewer/controlled water
- the quality of the receiving water
- the volume of discharge compared to the percentage of dry river flow of the receiving water

Environmental monitoring (beyond installation)

5.137 Environmental monitoring may be required, for example, when:

- there are vulnerable receptors;
- the emissions are a significant contributor to an Environmental Quality Standard (EQS) which may be at risk;
- the operator is looking for departures from standards based on lack of effect on the environment;
- the operator is required to validate modelling work.

Monitoring of process variables

5.138 Some process variables will have potential environmental impact and these should be identified and monitored where they have an environmental relevance. For surface treatment using solvents activities, examples of monitoring these variables include:

- keeping inventories of materials used and disposed of, in particular organic solvents;
- plant efficiency monitoring.

BAT	
116	The operator should monitor emissions, make tests and inspections of the process and keep records; in particular the operator should keep records of audits, inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. Monitoring may include process variables and operating conditions where relevant to emissions. In such cases; • Current records should be kept on site and be made available for the regulator to examine. • Records should be kept by the operator for at least two years
117	The operator should notify the regulator at least 7 days before any periodic monitoring exercise to determine compliance with emission limit values. The operator should state the provisional time and date of monitoring, pollutants to be tested and the methods to be used
118	The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of the completion of the sampling. Results from continuous monitoring systems should be recorded and be made available for inspection by the regulator.
119	All results submitted to the regulator should include details of process conditions at the time of monitoring, monitoring uncertainty as well as any deviations from the procedural requirements of standard reference methods and the error invoked from such deviations.
120	Results exceeding the emission limit value from any monitoring activity (both continuous and non-continuous) and malfunction or breakdown leading to abnormal emissions should be investigated and corrective action taken immediately. The operator should ensure that the regulator is notified without delay, identifying the cause and corrective action taken. Where there is immediate danger to human health, operation of the activity should be suspended.
121	Sampling points on new plant should be designed to comply with CEN or Other Standards.
122	Where available, operators should use monitoring equipment and instruments certified to MCERTS and use a stack-testing organisation accredited to MCERTS standards or such alternative requirements as approved by the regulator.
Monitoring and reporting of emissions to air	
123	Exhaust flow rates of waste gases should be consistent with the efficient capture of emissions, good operating practice and meeting the requirements of the legislation relating to the workplace environment.
124	The introduction of dilution air to achieve emission concentration limits should not be permitted.
125	Dilution air may be added where justified for waste gas cooling or improved dispersion. In such cases, monitoring should be carried out upstream of the dilution air input or procedures designed to correct for the ratio of input air to the satisfaction of the regulator.
126	Monitoring to determine compliance with emission limit values should be corrected to the following standard reference conditions: temperature, 273.15 K (0^{o}C), pressures 101.3 kPa (1 atmosphere) and measured wet, no correction for water vapour.
127	Periodic visual assessment of releases should be undertaken as required by the regulator to ensure that all final releases are colourless, free from persistent visible emissions and free from droplets.

128	For releases of VOCs calibration and compliance monitoring must meet the following requirements as appropriate: - In the case of continuous measurements the emission limit values should be considered to be complied with if: a) none of the averages over 24 hours of normal operation exceeds the emission limit values, **and** b) none of the hourly averages exceeds the emission limit values by more than a factor of 1.5. In the case of periodic measurements the emission limit values should be considered to be complied with if, in one monitoring exercise: a) the average of all the readings does not exceed the emission limit values; **and** b) none of the hourly averages exceeds the emission limit value by more than a factor of 1.5
129	Where VOC abatement equipment is fitted any measurements of total organic Carbon should be with a heated FID method (in line with revised EN 13649).
130	The frequency of manual sampling for VOC from abated releases must be at least annually
Monitoring and reporting of emissions to water and sewer	
131	The appropriateness of the monitoring requirements will vary depending upon the sensitivity of the receiving water and should be proportionate to the scale of the operations, nature of the discharge and receiving water. For each release point the following information is required: • the specific volume flow from the process to sewer/controlled water • the sensitivity of the receiving water • the volume of discharge compared to the percentage dry river flow of the receiving water
132	Increased monitoring should be carried out where substances to which the local environment may be susceptible could be released from the installation, e.g. where releases of biocides occur.
133	A full analysis, to include the substances listed in Part 1 of Schedule 1 of the EP Regulations and equivalent regulations in Scotland and Northern Ireland, should be carried out annually on a representative sample from each release point, unless it is agreed with the regulator that this is inappropriate.
Monitoring and reporting of waste	
134	The following should be monitored and recorded: • Quantity nature and origin of the waste • the physical description of the waste • a description of the composition of the waste • any relevant hazardous properties (hazard and risk phrases) • European Waste Catalogue code • Handling precautions and substances with which it cannot be mixed • Disposal routes for each waste category
Monitoring of VOC	

135	The definitions provided must be used in all calculations relating to the Solvent Management Plan (SMP)
136	The SMP should be used to determine the solvent consumption annually
137	The SMP should be used for determining the fugitive emissions. Once completed, it need not be repeated until the equipment is modified.
138	The SMP should be used to determine the actual emissions annually.
139	The SMP must be used to determine the Total Emission and the Solvent Input annually. In addition, the SMP should be used for determining the fugitive emissions. Once completed, it need not be repeated until the equipment is modified.

Information Provisions

5.139 This guidance note contains many provisions relating to information. There are two general categories of information identified in this note:

- Reports or notifications
- Additional information

5.140 Reports are required and notifications are information that should be sent to the regulator at a frequency that is specified in this guidance. Such information provisions are summarised in **Table 5.4**.

Table 5.4 - Summary of Provisions for Reporting and Notification			
BAT Clause	**Provision**	**Information Category**	**Frequency**
45	Report cause and nature of any persistent visible emissions.	Notification	Reactive
79	Notification of appointed competent person to liaise with the regulator and the public with regard to complaints	Notification	Reactive
110	Investigation of abnormal emissions arising from an accident. Remedial action taken immediately. Prompt recording of the events and actions taken. Notification of the regulator without delay*	Notification	Reactive
117	Notification at least 7 days before any periodic monitoring exercise to determine compliance with ELVs	Notification	Reactive
118	Report of results from non-continuous emission testing forwarded to the regulator.	Report	Within 8 weeks of the completion of the sampling – typically annual
120	Investigation of results exceeding an ELV from any monitoring activity and malfunction or breakdown leading to abnormal emissions. Corrective action taken immediately. Notification without delay* identifying the cause and corrective action taken.	Notification	Reactive
*Without delay In most cases it should be enough to notify the local authority (by telephone or facsimile or email) within an hour of the start or detection of the emission. Local authorities will wish to consider what notification arrangements to require outside working hours.			

5.141 Additional information relates to procedures or records (including details of assessments, investigations and audits). Such information should be held by the operator and be accessible so that the regulator may view the information. For much of the information, on-site inspection may be sufficient for the regulator, subject to the particular circumstances. Regulators may be more likely to ask operators to send them copies of those items marked with an asterisk. The majority of this information is likely to be the same as would be required in any event when using an effective EMS, so documents can be produced which serve both purposes.

5.142 Annex 4 of ISO 14001 gives some detailed examples of information and document control but by way of generality A.4.4 states that "The extent of the environmental management system documentation may differ from one organization to anther depending on:

a) the size and type of organization and its activities, products of services,

b) the complexity of processes and their interactions, and

c) the competence of personnel

Examples of documents include:

- statements of policy, objectives and targets,
- information on significant environmental impacts,
- procedures,
- process information,
- organisational charts,
- internal and external standards,
- site emergency plans, and
- records

5.143 Relating to documentation, Annex II of the EC Regulation No 1221/2009 on the eco-management and audit scheme (EMAS) provides details on what is required and includes the following headings:

- General requirements
- Environmental policy
- Planning
- Implementation and operation
- Checking
- Management review

5.144 Additional information provisions are summarised in **Table 5.5**.

Table 5.5 - Summary of Provisions for Additional Information		
BAT Clause	**Category**	**Subject**
33	Procedures	Pack movement controls.
56	Procedure	Discharges from bunds.
61	Procedures	SMP to be carried out (where used)
65	Procedures	Drainage inspection and management plan.
70	Procedures	Preventative maintenance programme for tanks, bunds and sumps.
71	Procedures	Control measures to minimise the pollution risk from solvent storage. (where used)
73	Procedures	Assessment of odour emissions.
74	Procedures	Odour control systems.
75	Procedures	Environmental Management System. Records of EMS audits.
77	Procedures	Operational and maintenance systems for all aspects of the installation whose failure could impact on the environment – annual review.
83	Procedures	Incidents and near misses investigation. Corrective action and following-up.
84	Procedures	Control the specification of raw materials with respect to their environmental impact. Review of alternative raw materials.
108	Procedures	Investigating accidents and near misses.
13	Records	Maintenance of impermeable surfaces in treatment area.
30	Records	Working vessel drainage.
64	Records	Subsurface structure mapping.
78	Records	Analysis of breakdowns in order to eliminate common failure modes.
87	Records	Raw material usage benchmarks.
88	Records	Waste minimisation audits and improvement programme.
91	Records	Water efficiency audit and water efficiency improvement programme.
94	Records	Water usage measurements.
95	Records	Waste inventory and treatment method.
101	Records	Annual review of waste disposal and recovery options.
103	Records	Annual energy report.

109	Records	Accident management plan.
115	Records	Identification of key plant and equipment with the potential to give rise to significant noise. Mitigation measures.
116	Records	Results from monitoring.
* Information that Regulators may be more likely to ask operators to send them copies of rather than relying only on inspection		

5.145 The amount of information and size of reports or documents required under the information provisions should be decided on a 'fit for purpose' basis. The label 'report' or 'record' should not be taken to imply that a sizeable document must be submitted if the required information can be provided in much shorter form. A report could comprise a paragraph or two if that was agreed to be sufficient for the purpose. Alternatively, lengthy documents may be necessary in particular circumstances.

All the information listed in Tables 5.4 and 5.5 is considered necessary either:

a) for regulators to keep a watch on the performance of an installation (e.g. monitoring data and who is the competent person to liaise with over complaints) or on the operator's efforts to improve performance (e.g. waste minimisation and energy audits); **and/or**

b) for operators to maintain an appropriate level of control over the installation, and which regulators should have access to should they wish to check that the information is being properly kept or to examine the information for regulatory purposes.

6. Further information

Sustainable consumption and production (SCP)

6.1 Both business and the environment can benefit from adopting sustainable consumption and production practices.

Estimates of potential business savings include:

- £6.4 billion a year UK business savings from resource efficiency measures that cost little or nothing;
- 2% of annual profit lost through inefficient management of energy, water and waste;
- 4% of turnover is spent on waste.

6.2 When putting in place arrangements to comply with permit conditions, operators are strongly advised to use the opportunity to look into what other steps they may be able to take. Local authority regulators may be willing to provide assistance and ideas, although cannot be expected to act as unpaid consultants.

Health and safety

6.3 Operators of processes and installations must protect people at work as well as the environment:

- requirements of a permit or authorisation should not put at risk the health, safety or welfare of people at work
- equally, the permit must not contain conditions whose only purpose is to secure the health of people at work. That is the job of the health and safety enforcing authorities

Where emission limits quoted in this guidance conflict with health and safety limits, the tighter limit should prevail because:

- emission limits under LAPPC relate to the concentration of pollutant released into the air from prescribed activities
- exposure limits under health and safety legislation relate to the concentration of pollutant in the air breathed by workers
- these limits may differ since they are set according to different criteria. It will normally be quite appropriate to have different standards for the same pollutant, but in some cases they may be in conflict (for example, where air discharged from a process is breathed by workers). In such cases, the tighter limit should be applied to prevent a relaxation of control.

Further advice on responding to incidents

The UK Environment Agencies have published guidance on producing an incident response plan to deal with environmental incidents.

It is not envisaged that regulators will often want to include conditions, in addition to those advised in this SG note, specifying particular incident response arrangements aimed at minimising emissions. Regulators should decide this on a case-by-case basis. In accordance with BAT, any such conditions should be proportionate to the risk, including the potential for harm from emissions if an incident were to occur. Account should therefore be taken of matters such as the amount and type of materials held on site which might be affected by an incident, the likelihood of an incident occurring, the sensitivity of the location of the installation, and the cost of producing any plans and taking any additional measures.

Risk Phrase Classifications

As from 1st December 2010 “risk phrase” materials will also be known as “hazard statement” materials. Both terms will apply until 1st June 2015, when only the term “hazard statement” materials will apply. This change will not have an impact on the regulatory position under IED, all requirements regarding risk phrase materials still applying for hazard statement materials. However, as the identifier for the risk categories will change Table 6.1 below has been included to allow comparison between the two ways of labelling hazardous materials.

Table 6.1 - Classification of hazardous materials			
			SE only catches halogenated VOC with the phrases/statements in this column
Risk Phrases	**class 1 'known to'**	**class 2 'treat as'**	**class 3 'cause concern'**
Hazard statements **categories** **They are NOT exact equivalents**	category 1a **known** from human evidence	category 1b **presumed** from animal evidence	category 2 **suspected** human carcinogens
	H340, H350, H350i, H360D or H360F		H341 H351
Carcinogens	R45 May cause cancer H350 May cause cancer	R45 May cause cancer H350 May cause cancer	R40 Limited evidence of a carcinogenic effect H351 Suspected of causing cancer
Mutagens	R46 May cause heritable genetic damage H340 May cause genetic defects	R46 May cause heritable genetic damage H340 May cause genetic defects	R68 possible risk of irreversible effects H341 Suspected of causing genetic defects
Carcinogen by inhalation	R49 May cause cancer by inhalation H350i May cause cancer by inhalation	R49 May cause cancer by inhalation H350i May cause cancer by inhalation	R40 Limited evidence of a carcinogenic effect H351 Suspected of causing cancer
Toxic to reproduction	R60 May impair fertility - and R61 May cause harm to the unborn child H360D or H360F May damage fertility or the unborn child	R60 May impair fertility - and R61 May cause harm to the unborn child H360D or H360F May damage fertility or the unborn child	**Outside SE**- R62 and R63 for the suspected R phrases say possible risk to.

7. References